JANUARY, 1956

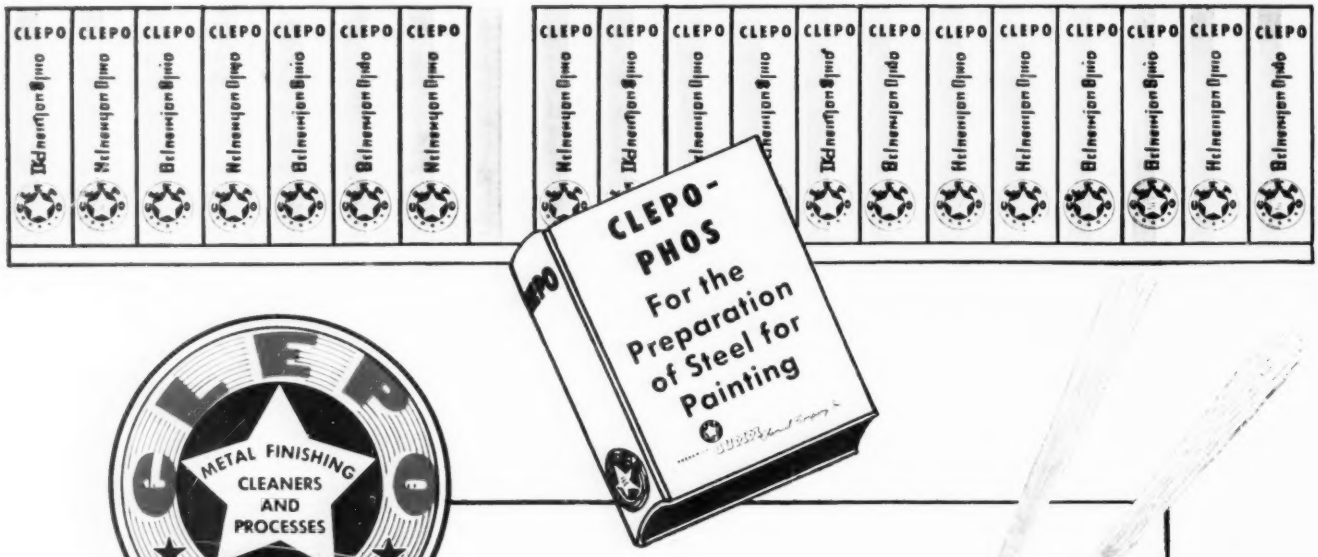
METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

FOUNDED 1903

READ & PASS ON

LIBRARY OF CLEPO SERVICE



CLEPO
METAL FINISHING CLEANERS AND PROCESSES

Clepo-Phos *Conditions* STEEL WHILE IT CLEANS

Assuring Enduring Paint Adhesion

This matter of surface conditioning is vitally important.

It's not enough to thoroughly clean and dry a steel surface prior to painting. By its very nature, steel offers little in the way of "anchoring" characteristics for paint adhesion. But steel can be conditioned while being cleaned.

CLEPO-PHOS does this conditioning. It is formulated for spray or still tank cleaning, not for brush-on application. Conventional steel tanks or machines can be used. No special resistant metal is required.

CLEPO-PHOS cleans, yes, and thoroughly, but in the process it sets up a reaction that produces a thin but strongly adhering coating of iron phosphates. On this coating, paint will adhere for a long, long time.

And this surface conditioning can be obtained quite economically. Why not order a workable test sample of CLEPO-PHOS and give it a good trial on your pre-paint operations. If, in the meantime, our field service man should drop in, ask him to tell you more about CLEPO-PHOS...and other CLEPO Products which might be helpful in your operations.

• • •

CLEPO-PHOS is only one of many, many chemicals developed by our research staff which combines technical skill and sound, practical knowledge of your industry's requirements. CLEPO stands for technical service as well as for quality products.

FREDERICK GUMM *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N.J.

Metal Finishing is published monthly by the Finishing Publications, Inc., 381 Broadway, Westwood, New Jersey, U.S.A.
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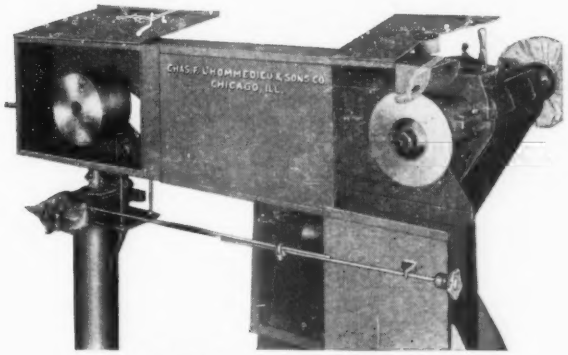
USE "RELIANCE" PRODUCTS FOR

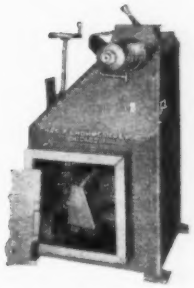
ECONOMY : EFFICIENCY : DEPENDABILITY

WRITE FOR FURTHER DETAILS



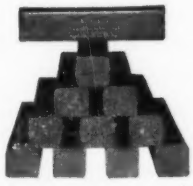
BACKSTAND IDLER WITH LATHE

OBLIQUE
TUMBLING BARREL



#23A
POLISHING LATHE

BACKSTAND IDLER



EXTRUDED COMPOSITIONS
STANDARD SIZE
2 x 2 x 10"

NUWAY BUFFS FOR
FAST CUTTING

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS of

Plating and Polishing Machinery

Complete Plating Plants Installed

C. B. Little
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104 Second Street
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Gen. Office and Factory:
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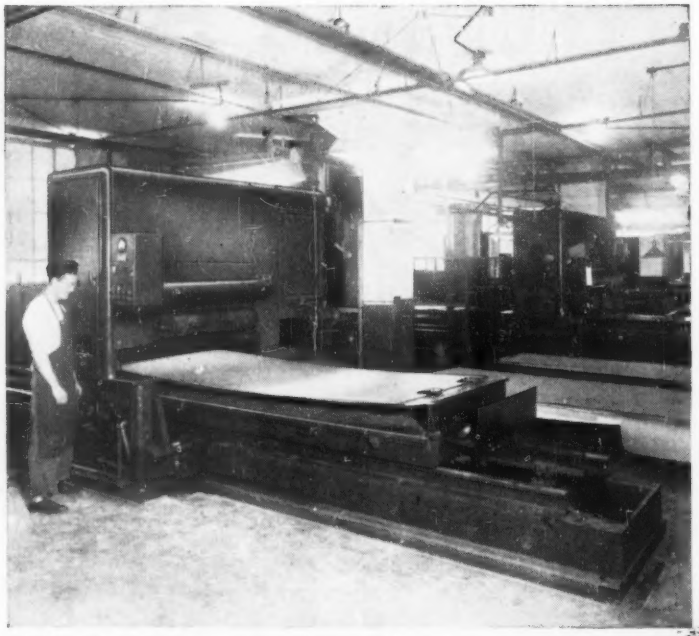


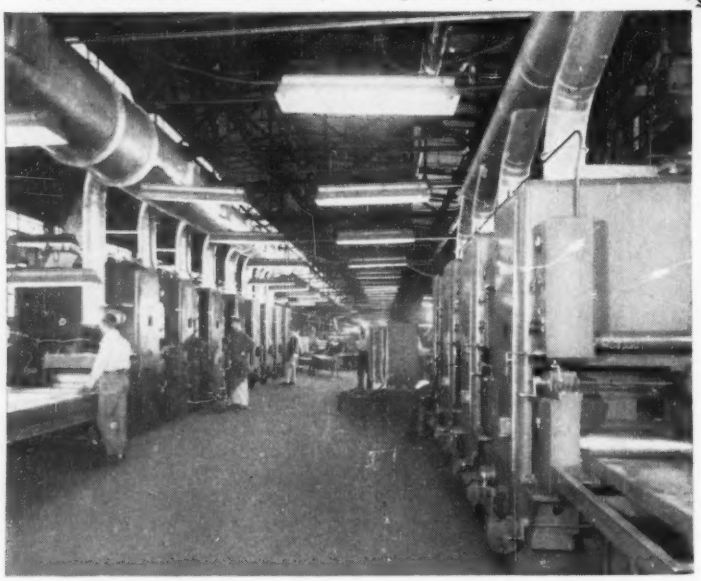
HILL Sheet Grinder and Polisher with reciprocating hydraulic table processing individual sheets.

HILL

GRINDING and POLISHING MACHINES

How much is it costing you to produce ACCEPTABLE finishes on FLAT surfaces

HILL Pinch Roll Grinder and Polisher for "Wet" or "Dry" operations. (Shown in series for straight line production)



HILL 2-Roll Vertical Abrasive Belt Grinding and Polishing machines are the logical result of 25 years of research and experience in producing self contained units for successfully processing ferrous and non-ferrous sheets. We have consistently proven that wide abrasive belt grinding and polishing equipment must incorporate these fundamental features — rugged construction, simplicity of design, accessibility, versatility and centralized controls.

HILL abrasive belt polishing machines are recommended for continuous operation and insure lower production costs with superior finishes as required today by the manufacturers of decorative plastics, food processing equipment, automobile bumpers, lithographers and photo engravers plates, home appliances, etc., etc.

Both types of machines are normally built up to 60″ wide, and larger capacity equipment can also be furnished.

Your inquiries are solicited for detailed information and recommendations.

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

1209 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

5 Rapid Selenium Rectifiers form Power-Packed Line-up at Warner & Swasey

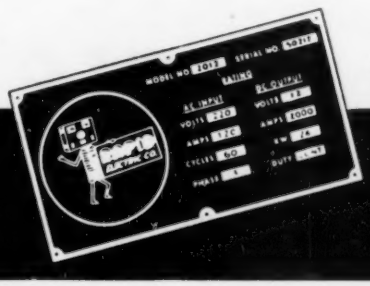
Warner & Swasey's chromium plating installation features a power-packed line-up of five Rapid Selenium Rectifiers. It's Rapid power, then, along with extensive know-how and other excellent equipment that helps Warner & Swasey turn out only quality chromium plating which is in keeping with their reputation for building the finest of precision, metal-turning machine tools.

"Multiple Rapid" installation such as this are not uncommon. Because, once a plater buys a Rapid Rectifier, he almost always buys more as his power needs increase. Additional Rapid Rectifiers are specified because of the complete satisfaction derived from the efficient, dependable, low cost performance of the original unit. It is this feeling of satisfaction on the part of our plating customers that is responsible for Rapid's growth in the industry.

Plating men know that when they specify Rapid for their DC Power needs, they are getting first of all, an engineered DC power supply which gives them six square inches per ampere of plate surface and many other "plus" features, such as:

- **Long-time service**
- **High efficiency**
- **No lost time due to burnouts**
- **No loss of efficiency due to overheating**
- **No supervision needed**
- **No maintenance needed**
- **Maximum Safety Features**

Our engineering department is available for consultation on any application of Direct Current Power Supplies. Avail yourself of this professional service without obligation.

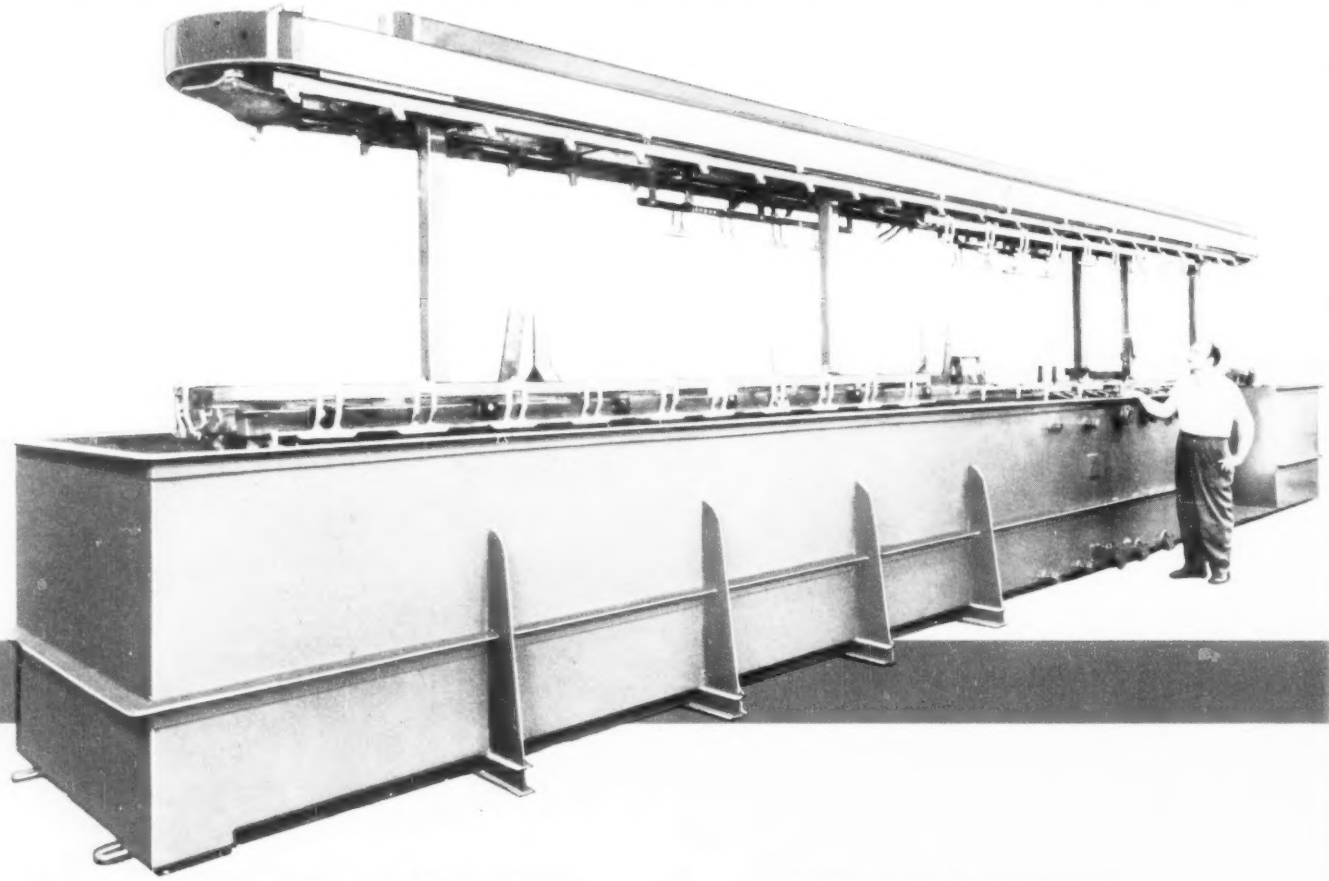


THE NAMEPLATE THAT MEANS *"More Power to You!"*

RAPID ELECTRIC COMPANY

2891 Middletown Avenue • New York 61, N. Y. • Phone TAlmadge 8-2200

THE CYCLEMASTER



The Udylite Cyclemaster is a new, completely automatic plating machine which offers the greatest production of any machine built with comparable floor size. It is the result of over two years of research and experimentation, and incorporates the famous Udylite features of construction and engineering which are so well accepted in the plating industry.

A VERSATILE, STANDARDIZED MACHINE

The Cyclemaster is a standardized machine. Overall length, width and height of the machine, and depth of tanks, are standardized. This permits lower manufacturing costs with the benefits passed on to the user. The lengths of the various process tanks are changed to accommodate the rack size and the desired cycles of plating or processing in this machine. This means high production plating with a low initial machine cost.

WILL HANDLE MOST PLATING CYCLES

Ideal for cadmium and zinc plating, the Cyclemaster can also be used for copper-nickel-chrome plating and other processes where the cycle will fit into its 41 foot, 6 inch length. It will easily handle 120 racks per hour and take a rack size up to 16 inches by 36 inches. Every phase of the cycle is adjustable and its performance provides perfect uniformity in the plated product. Before building the Cyclemaster, The Udylite Corporation made a survey of the plating industry which shows that this machine will meet the requirements of over 50 per cent of the plating work in shops throughout the country.

ONE MAN CAN OPERATE

Being fully automatic, the Cyclemaster does not require the constant attention of experienced platers. Its operation is so simple any regular shop man can keep it operating at full capacity. One man can handle both loading and unloading.

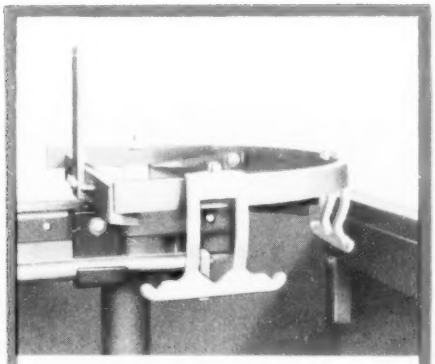
NEW MULTI-PURPOSE CARRIER

All Cyclemaster units are equipped with a new, standard multi-purpose carrier, which can be used for double spline or single spline racks. Made of special alloy metal, it has high structural strength and highest conductivity. The Cyclemaster carrier can also be easily adapted to inside anode plating if required.

HAS FAMOUS UDYLITE FEATURES

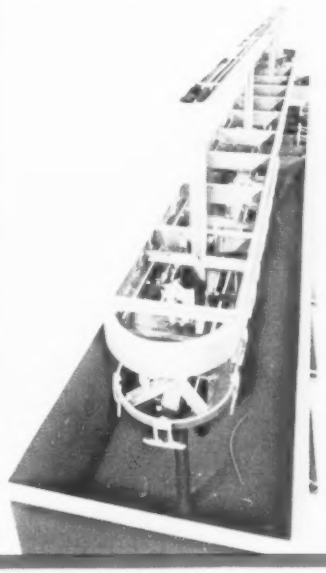
Like other Udylite machines, the Cyclemaster is completely assembled at our plant and run in before being shipped as a complete unit . . . rack spacings can be varied in individual tanks . . . machine is operated by hydraulic mechanism permitting variable speeds for lift, lowering or horizontal movement of racks in and out of solution . . . tanks, which are ventilated, have shields over them which permit a reduction of the amount of air exhausted to the outdoors, cutting down fuel consumption . . . through the simple one-piece cast carrier the current travels only 6 inches from the cathode rail to the rack . . . there are less moving parts on all Udylite machines than on any other type on the market . . . horizontal transfer of the work carriers is accomplished by a simple tee member pusher mechanism that is hydraulically operated . . . *no* chains are used for horizontal work transfer.

by UDYLITE FOR HIGHER PRODUCTION LOWER COST PLATING



Special alloy metal carriers have high conductivity and will take one or two splined racks.

Compact design requires a minimum of floor space. The Cyclemaster is only 41 feet 6 inches long, 7 feet wide.

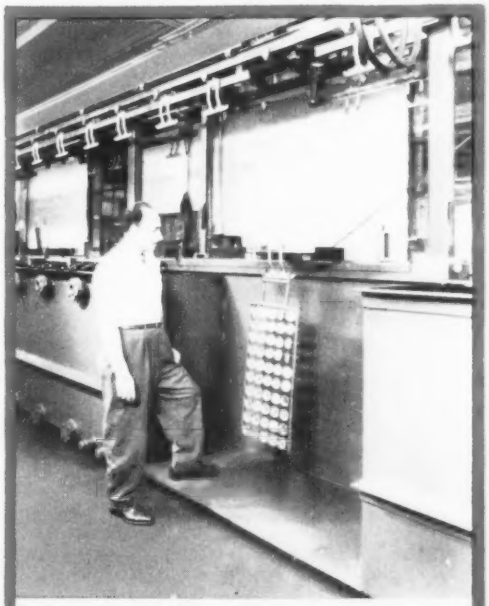


EASILY SHIPPED AND INSTALLED

Built on a rugged 4 inch I-beam base, the Cyclemaster can be shipped as a complete unit, or if desired, in two sections, which require only bolting of the two sections together. This permits easy shipment by either truck or rail flat car.

DELIVERY

The standard machine (which is ideal for cadmium or zinc) with 14 inch by 36 inch rack is carried in stock for immediate shipment. However, because of standardized design, excellent delivery can be made even on Cyclemasters where a special processing cycle is required.

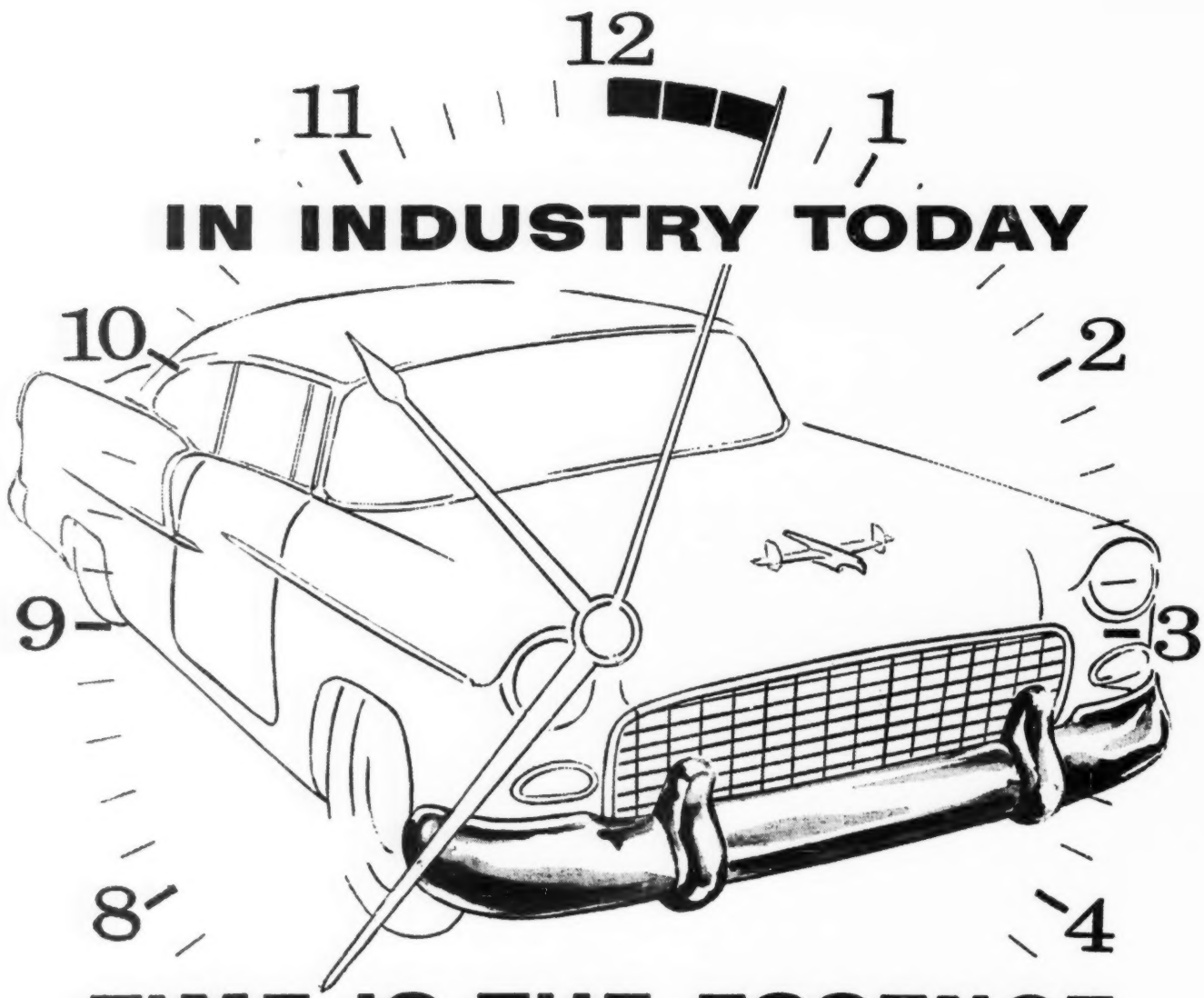


Variable rack spacing allows ample room for load and unload—side load or end load available—one man operation.

For more details regarding the Cyclemaster—or any other Udylite equipment—consult your local Udylite representative or write today to The Udylite Corporation, Detroit 11, Michigan.

THE Udylite CORPORATION DETROIT 11, MICHIGAN

WORLD'S LARGEST PLATING SUPPLIER



IN INDUSTRY TODAY

TIME IS THE ESSENCE

An automobile bumper chromium-plated every three seconds! This is the rate at one plant where 170,000 square feet of metal are plated daily.

Production of that sort can be maintained only when raw material suppliers have ample capacity and adequate stocks to insure prompt shipment.

Chromium platers who obtain their chromic acid from Mutual are not only assured of receiving a top-quality product, but also careful compliance with their delivery schedule.

CHROMIC ACID

•

SODIUM BICHROMATE

•

POTASSIUM BICHROMATE

MUTUAL CHEMICAL DIVISION

MUTUAL

ALLIED CHEMICAL & DYE CORPORATION

99 PARK AVENUE • NEW YORK 16, N. Y.

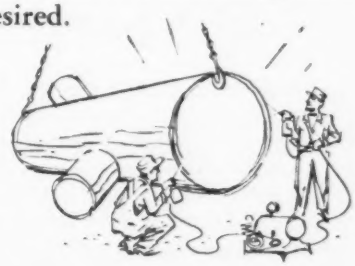
Allied Chemical

DON'T MISS THE BOAT!

MICCROSOL SPRAY S-2003 IS READY . . . to show YOU the way to profitable spray jobs

You can apply S-2003 with conventional spray equipment.

You can apply 60 mils thickness in one application without sagging of material. If multiple coats are required, a short cure time is all that's needed between applications. A contrasting color can serve for layer identification, if desired.



You can use S-2003 in all plating baths. It has the same toughness—chemical, corrosion, and abrasion resistance as Miccrosol E-1003. Our adhesive systems provide outstanding adhesion to metal surfaces.

Tanks
Ducts
and other
Equipment

Solvent additives are not necessary. S-2003 is 100% solids and is sprayed as received. Time consuming and expensive adjustments are unnecessary. Problems of material instability and film cracking are eliminated. There is no solvent loss and less operator fatigue with Miccrosol Spray S-2003.

It's the ideal plastisol for spray applications.

• *WRITE FOR PARTICULARS ON COMPANY LETTERHEAD*

Developed and manufactured by experienced platers

MICHIGAN CHROME *and Chemical Company*

8615 Grinnell Avenue • Detroit 13, Michigan

36

PENNSALT CLEANER 36 is an extra-heavy-duty alkaline soak-tank cleaner that removes the bulk of the greasy, oily soils on steel or copper parts before electrocleaning. Thus the electrocleaner bath lasts longer, works more efficiently on smut and impacted soil. Pennsalt Cleaner 36 keeps soil in suspension once it's removed, won't let it redeposit on the work.

K-8

PENNSALT CLEANER K-8 is the king of all electrocleaners, recommended for removal of the toughest impacted soils and pickling smuts. An excellent conductor, K-8 lets maximum current flow at low voltages. Plating rejects drop to a new low—your production becomes more profitable.

PM-90

PENNSALT CLEANER PM-90® is a balanced inhibited-acid pickling agent that removes all traces of rust and scale, leaving the base metal bright and ready for a highly reflective plate. Special conditioning of PM-90 does away with the film problems formerly associated with acid pickling. No more fume problems, either; pickling is fast and trouble-free.

Pennsalt Chemicals

Metal Cleaners • Phosphate Coatings • Cold-Working Lubricants

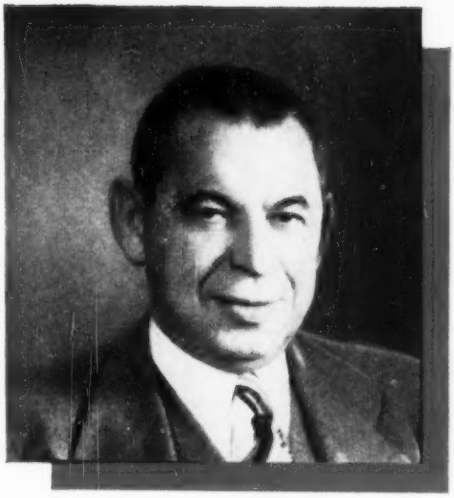
Super-clean control all down the line with Pennsalt's NEW Super-cycle

NOW—electroplaters can be sure of complete control over the cleaning cycle, and thus benefit through an amazingly bright, uniform plate . . . a drastic cut in plating rejects . . . true economy in chemicals and operation. By using the new Pennsalt Super-Cycle, you assure yourself a *perfect balance* of high-potency cleaners designed for each other and for your plating line. These cleaners are great separately—but they're SUPER when used in the Super-Cycle!

LONG BATH LIFE. The unusual teamwork of the Super-Cycle extends the life of all three baths by giving one specialized job to each cleaning tank. Thus your steel or copper parts are speeded through the cycle, given "expert" care in each stage. Results: A wider margin of safety, a top-quality plate, a shattered record for low rejects.

WATCH THE SUPER-CYCLE WORK in *your* plating line, and learn the pleasant price facts about all three cleaners bought as a unit! Call the Pennsalt man for a demonstration in your equipment, or write Metal Processing, Dept. 213, Pennsylvania Salt Manufacturing Company. East: Three Penn Center Plaza, Philadelphia 2, Pa.; West: Woolsey Bldg., 2168 Shattuck Ave., Berkeley 4, Calif.

A BETTER START FOR YOUR **PLATED** FINISH



A Timely Message on

Are Presidents People?

by Ben P. Sax

President, American Buff Company

How would you like to attend a *different* party? You probably know companies who have had birthday parties for the oldest employee, or to honor someone who was elevated to a Cabinet post.

Recently, a good friend invited me to attend a most unusual party—a surprise party for his boss, the firm's president! It wasn't to celebrate his birthday, nor a business anniversary. It was a party to express honest affection for a grand man who had built his business "from scratch" by hard, intelligent labor and honest service.

It was an accolade of honor from his employees and associates, an effort to convey to him how much they admired him for what he had done—not only as an employer, but also as a friend and as a man.

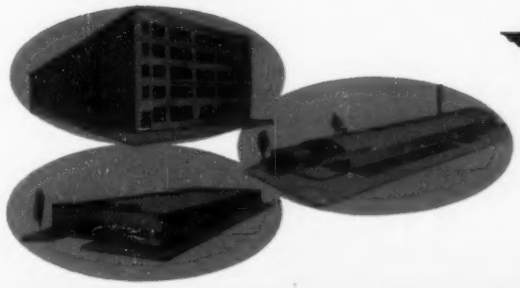
In some ways, this job of being president is one of the loneliest in the world. To everyone below him in the organization, he is THE BOSS—to be feared in some cases, respected in others, and obeyed at all times. Over him are the board of directors and stockholders, ready to criticize if anything goes wrong, seldom willing to praise when things go right. Truly, he is "between the devil and the deep blue sea"!

We are all human beings—even presidents! The man who was honored at this party was extremely happy! For once in his life, he received a nice pat on the back . . . something that everyone likes, but that presidents seldom get.

So, I am in hearty agreement with the idea of a "surprise party" for presidents, if for no other reason than that they are human beings and welcome a little encouragement.

Sincerely,

Ben P. Sax



"For the job that's TOUGH—use an AMERICAN BUFF"

American Buff Company

2414 S. LA SALLE STREET · CHICAGO 16, ILLINOIS

World's Largest Manufacturer of Buffs and Polishing Wheels for Every Finishing Operation.

UNIT • UNIT SISAL • BIAS SISAL • OPEN BIAS SISAL

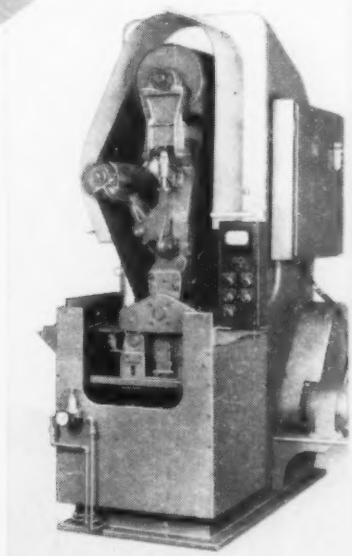
Patented Centerless or Permanent Center Construction

AMERICAN BUFFS ARE REGULARLY ADVERTISED IN FORTUNE MAGAZINE

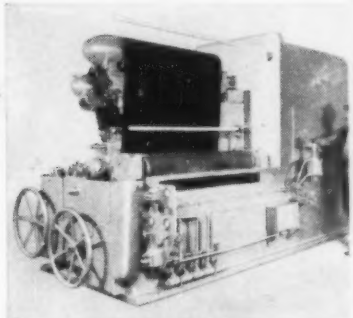
FLAT POLISH

Slash production costs EIGHT ways with MICRO-POLISH

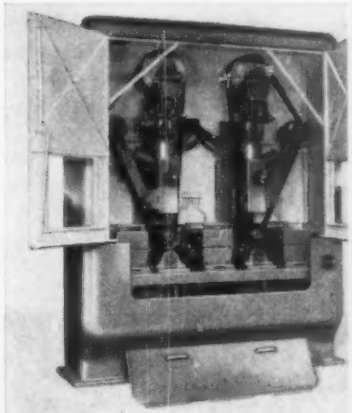
1. More square foot area can be pre-polished in a fraction of the time required for any type of contour polishing.
2. Cost per square foot is by far the lowest of all methods.
3. Use of lower steel grades rather than higher finishes give larger initial stock saving.
4. Improves press and die action.
5. Pre-polished steel (5-8 micro-inches) produces outstanding results with the most exacting, modern plating practices.
6. Pre-polished steel provides a uniform surface giving a plating deposition of maximum protection with minimum plating.
7. Prefinishing with subsequent forming produces lower unit cost.
8. Rejects due to base metal finishing are essentially eliminated.



Small unit for polishing narrow strip or sheet stock.



A Micro-Polish giant used in reclamation grinding of steel strip.



Space saver unit for polishing flat bar stock. Two heads and two grades of belt grain accomplish the complete job without rehandling.

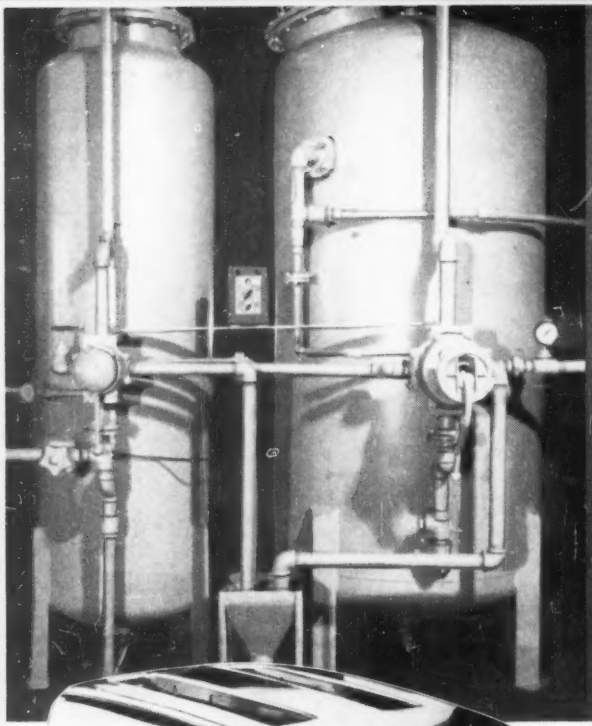
"Complete Package" Murray-Way will engineer a complete automatic finishing line or a single machine to aid you in reducing your operating costs, improve finishes and increase production. For complete information—CALL OR WRITE

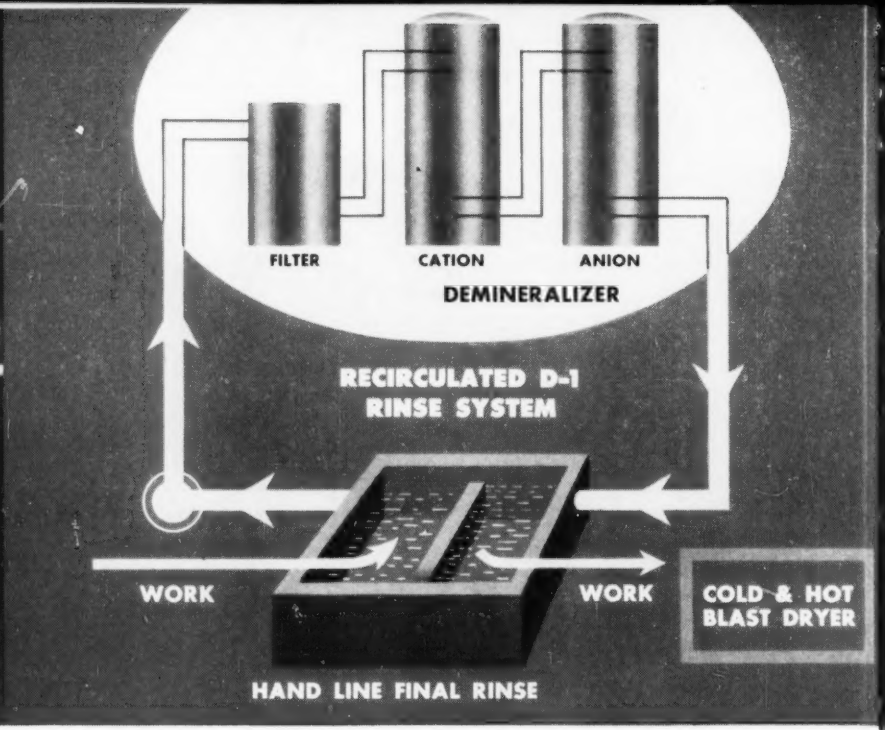
MURRAY WAY

MURRAY-WAY CORPORATION

P. O. BOX 180, MAPLE ROAD EAST · BIRMINGHAM, MICH.

Polishing, Buffing, Grinding, Filtering Equipment that automatically cuts your costs.





Toastmaster improves finish... lowers production costs with

INDUSTRIAL'S

Rinse Recirculation System

Water with only a few grains of natural solids tastes just fine . . . but if you want top-notch plating, even mineral *traces* will interfere . . . and keep your costs up too.

In looking for a way to make a fine product even better the engineers at the Toastmaster Products Division of McGraw Electric Co. studied their plating process. They consulted Industrial and received a thorough analysis of the water used in their plant at Elgin, Illinois. Industrial recommended an ion exchange system for the final rinse water.

Ion exchange unit greatly reduces final color buffing

The Industrial Recirculation System *continuously* purifies the rinse water. This mineral free water permits a final plate job that reaches Toastmaster's high standard with very little color buffing.

IMPORTANT SAVINGS INCLUDE:

- ★ **Buffing costs, necessary power and material**
- ★ **50,000 gallons of water per week**
- ★ **Cost of purifying chemicals is less than 10% of previous method. Using cation and anion resins resistant to chromic acid, it costs only 2.6¢ to re-purify 1000 gallons of water.**

If your company, like McGraw Electric Co., is interested in quality plating and reduced costs, the best investment you can make, is a talk with Industrial's consultants. Their experience with plating problems can save you thousands of dollars.

Write or call Industrial . . . a short outline of your problem will bring specific data.

Write for 24-page book . . .
"Practical Methods for Treatment of Metal Finishing Wastes"
. . . covers major problems and their solutions, including 6 case histories detailed with costs.

CENTRIFUGAL PUMPS • PRESSURE FILTERS • ION AND HEAT EXCHANGERS • RUBBER LININGS • WASTE TREATING EQUIPMENT

Industrial

INDUSTRIAL
FILTER & PUMP MFG. CO.
5906 Ogden Avenue • Chicago 50, Illinois

3 NEW PRODUCTS!

NEW!
DIFFERENT!
--but Production Proven

These three numbers are available in new, longer, "nubbin saving" containers. They are manufactured up to 100% saponifiable, resulting in easier cleaning, quicker acting and cost cutting compositions for you. Try these new time savers now, Mr. Polishing and Buffing Superintendent.

Call collect or write for your free samples and prices pronto!

Schaffner
manufacturing company, inc.
EMSWORTH, PITTSBURGH 2, PA.

Clip To Your Letterhead

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Schaffner
manufacturing company, inc.
SCHAFFNER CENTER, EMSWORTH, PITTSBURGH 2, PA.

Please send me more detailed information about your new buffing compounds. I would also like to have your free sample(s) of
☐ LIME ☐ GREASE STICK ☐ STAINLESS

Name _____

Title _____

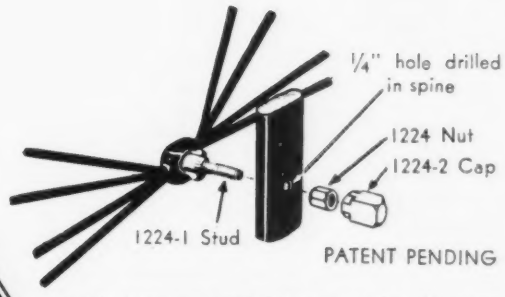
Company _____

Street _____

City _____ Zone _ State ____

The Right Plating Racks when you NEED them —at LOW cost!

Thinker Boy 30" Spine complete only $2.85



PATENT PENDING

Just drill holes and install Thinker Boy Tips where you want them in Thinker Boy Rack Spines.

You have completely insulated racks designed for the job in minutes. No dipping. No baking. No waiting. The only tools you need are a drill and pliers.

Think of the advantages you get with Thinker Boy

No Waiting—You can have the right racks for every job when you need them. Get all jobs out on schedule without excessive costs from inefficient racking.

Cut Rack Costs—Thinker Boys don't become useless. You can quickly change tips or adjust spacing to rack different articles. Thinker Boy Spines are mass produced and cost so little you can have spines with many different spacings.

Adaptability—You can quickly and easily adjust each Thinker Boy Tip to hold an amazing variety of articles.

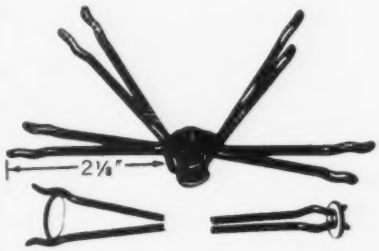
Reduce Handling Time—You can couple the spines with Thinker Boy Cross Members for increased handling efficiency.

Unlimited Flexibility—You can quickly assemble racks of many different types and styles with a small assortment of Thinker Boy Sections.

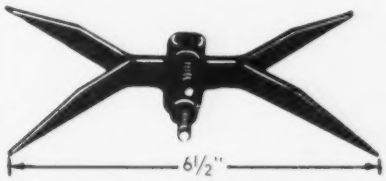
You can save money by getting acquainted with Thinker Boy. The new Thinker Boy Catalog is a veritable road map to increased racking efficiency and reduced racking costs. Send for your copy, NOW. Just mail the handy coupon.

Four Most Popular Thinker Boy Tips

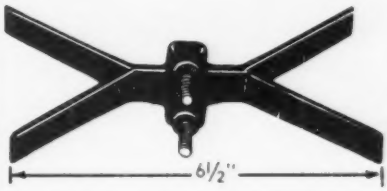
All Thinker Boy Tips are easily adjusted to hold different articles.



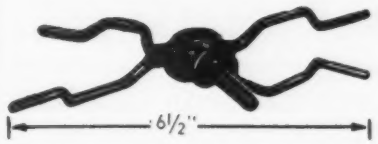
RS-207. Same design as the popular Style 1 Utility Tip. Has 8 prongs arranged in 4 pairs—formed to hold objects under spring tension from either inside or outside. Wire sizes: 1/16", .072" and .080". Universal Plastic Coated.



FS-102. Same design as the Style 4 Utility Tip, except has double knurler. 1/16" x 5/8" phosphor bronze. Universal Plastic Coated.



FS-101. Same design as Style 3 Utility Tip, except has double knurler. Excellent for racking objects that tend to wobble. Square ends are easily shaped when necessary. 1/16"x5/8" phosphor bronze. Universal Plastic Coated.



RS-201. Same as Style 2 Utility Tip. Wire sizes: 1/16", 3/32", .114" and 1/8". Universal Plastic Coated.

Belke MFG CO

947 N. Cicero Ave.
Chicago 51, Ill.

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Cross Buffing

A NEW PRINCIPLE IN BUFFING POSSIBLE ONLY WITH

COLOSSUS AIR COOLED BIAS BUFFS

Check these additional features

- One-way fabric warp direction for faster cutting.
- Fabric locked with wire stitching for greater safety.
- Forced air cooling through scientifically designed air scoops in center plate.
- Up to 30% longer wear life.

Pat. No. 2637149
other patents pending

Precision convolution pleats produce cross buffing action which eliminates buffing streaks—cuts rejects.

...and they cost no more than ordinary bias buffs!

Send for free catalog and learn how Colossus Air Cooled Bias Buffs can cut your buffing costs.

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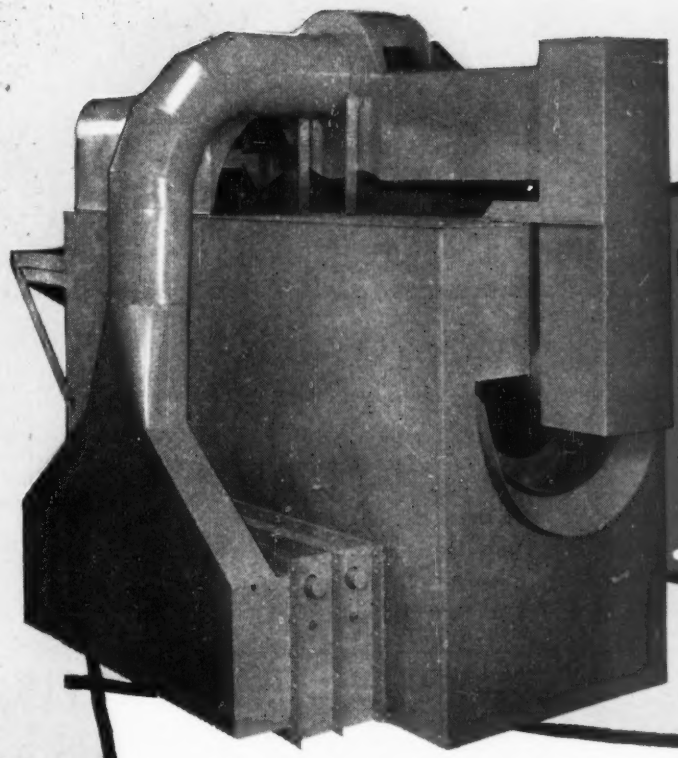

Bone Dry.. Up To 900 Quarts Of Parts Per Hour ...Automatically!

LASALCO's *New* SPIRAL DRYER

SPECIFICATIONS

SIZE: Length 9' 0", Width 4' 6", Height 6' 0"

DRUM SIZE: 22" Diameter, 72" Long, 9" Screw

DRUM PERFORATIONS: ⅛" (Other sizes available)

DRYING TIME: (Aver.) 3-5½-9½ minutes

PRODUCTION: 30 to 900 Quarts per hour (40 to 120 cubic feet)

DRIVE: ½ HP 220/440 volt, totally enclosed ball bearing motor, 1200 RPM

DISCHARGE CHUTE: 20" From Floor (minimum)*

LOADING CHUTE: 42" From Floor

HEATER: Steam—Aerofin blast coils with 1 HP fan for recirculation of air. (Also available with gas heat.)

*Can be arranged for any height from tote pan to 55-gal. drum.

- Virtually eliminates *all* drying labor.
- Hot blasts parts completely dry over a 3-speed spiral—automatically—regardless of design, recesses or contours in the work.
- Automatically unloads into barrels or tote pans. Instantly ready for the next load.
- Specially designed heater eliminates all moisture from the air.
- Replaces up to 3 sawdust tumblers plus 2 or 3 centrifugal dryers.
- Can be arranged to take full hopper loads from final hot water rinse without handling.

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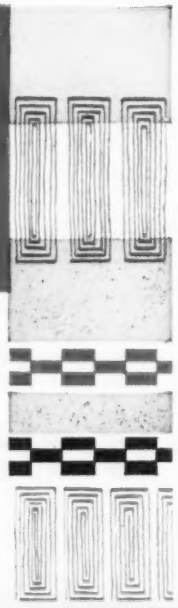
From MEXICO

. . . and **JOE-D**

Come the Original BIAS SISAL BUFFS



GUARANTEED FRAYPROOF PERFORMANCE!

The high-quality sisal used in **every** JOE-D Buff is grown and specially woven for JOE-D in Yucatan, Mexico. Top quality raw material is one reason why JOE-D Sisal Buffs are the finest on the market — **fast-cutting, long-lasting.** And JOE-D's **original** bias construction guarantees **frayproof** performance — never a loose thread end to scratch or mar. Insist on **original** quality . . . specify JOE-D —you can't buy a better buff!

The JOE-D line covers a complete selection of Bias, Bias Sisal, Bias Spoke (Finger) and Conventional Buffs—as well as quality Polishing Wheels.

Holders of the original patent on Bias Sisal Buffs— U.S. Pat. No. 2642706

ATTENTION JOBBERS!

Some choice territories still available. WRITE TODAY!

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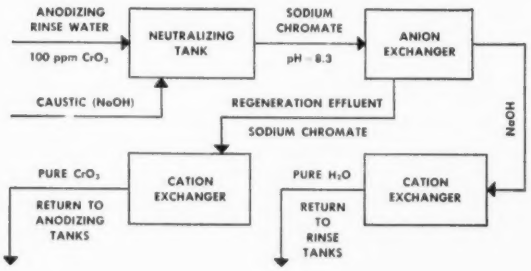
ILLCO-WAY ionXchange



RECOVERY OF CHROMIC ACID FROM ANODIZING RINSE WATER

The block diagram above indicates one method of using ionXchange to save money, in the plating rooms of a large automobile plant, by recovering the chromic acid from the rinse tanks of anodizing operations. The cost of equipment was much less than the cost of a disposal plant, and the savings through recovery were substantial enough to make the investment a very profitable one.

REMOVAL OF ALUMINUM FROM ANODIZING BATH

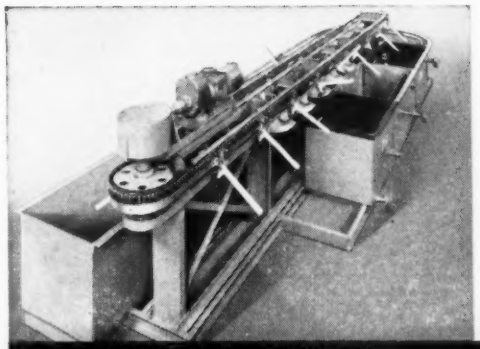
A secondary purpose for one part of the same installation was the removal of aluminum from the anodizing baths. When the concentration of aluminum in any anodizing tank rose to nearly 1 g. per liter, that tank was cycled through the cation exchanger and the aluminum removed, thus saving over $250 a week compared with partial dumping. *For details on this and many other money-saving applications of ILLCO-WAY ionXchange, write us or consult your Illinois Water Treatment Company representative.*

ILLINOIS WATER TREATMENT CO.

840 CEDAR ST., ROCKFORD, ILLINOIS

ILLCO-WAY ionXchange

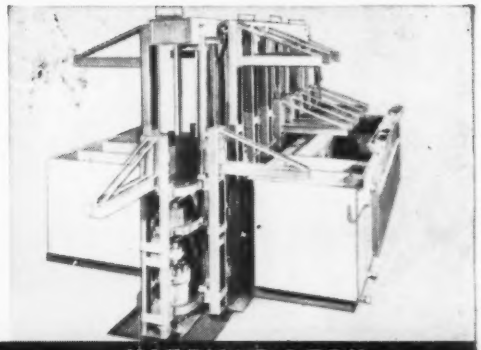
NEW YORK OFFICE: 141 E. 44TH ST., NEW YORK 17, N.Y.
CANADIAN DIST. PUMPS & SOFTENERS, LTD. LONDON, ONT.



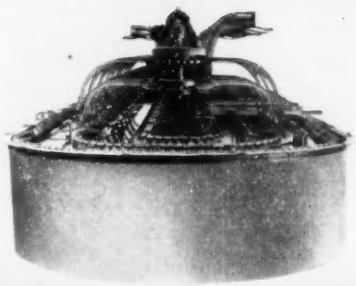
"LITTLE STEVE"
Rack Type Machine

Low initial and low operating costs are features of this newly introduced small automatic which has a big capacity for its size.

Unit's load capacity, mechanical flexibility and lift design meet tomorrow's increased safety and production requirements.



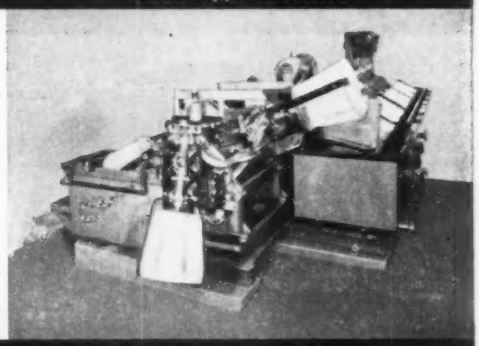
"STEVADOER"
Rack Type Machine



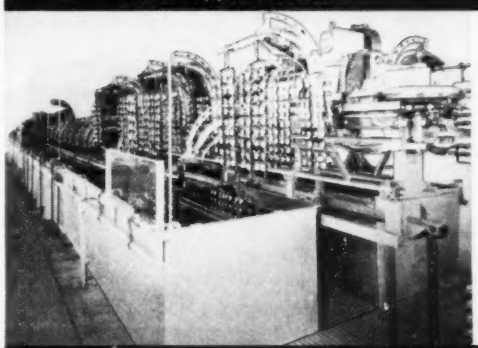
MODEL "A"
Rack Type Machine

A compact automatic processing machine, embodying the famous Stevens auxiliary cam shaft and lifters for rapid vertical transfer.

A proven automatic barrel machine for plating and processing small parts. Only unit with fully automatic load and unload features.



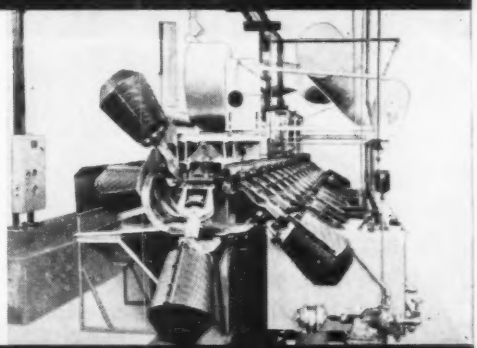
MODEL "C"
Barrel Type Machine



MODEL "B"
Rack Type Machine

Features rapid, continuous movement processing employing hump type cams. Design permits utmost mechanical and cycle flexibility.

Large capacity automatic barrel unit for volume production. Embodies major features of the famous Stevens Model "C" machine.



"SUPER E"
Barrel Type Machine

AN AUTOMATIC MACHINE FOR EVERY METAL FINISHING NEED

The Stevens family is now complete Six Stevens automatic plating and processing machines fill every need for metal finishing

Latest addition to the complete line of Stevens automatic metal finishing machines is "Little Steve." Announcement of the new "Little Steve" follows by a few months the recent introduction of Stevens heavy-duty "Stevadoer" Processing machine.

Now you can go automatic in any and all of your plating operations. Stevens can furnish a job-engineered, cost-cutting, fully automatic machine that will answer every production need whether it be for electroplating, cleaning, anodizing, bright dipping. You will get better control, better finishes and eliminate rejects with Stevens Automatics.

Why not see how one of Stevens great family of automatics can be engineered for your metal finishing operations? Call in a Stevens Sales Engineer today or write direct to —

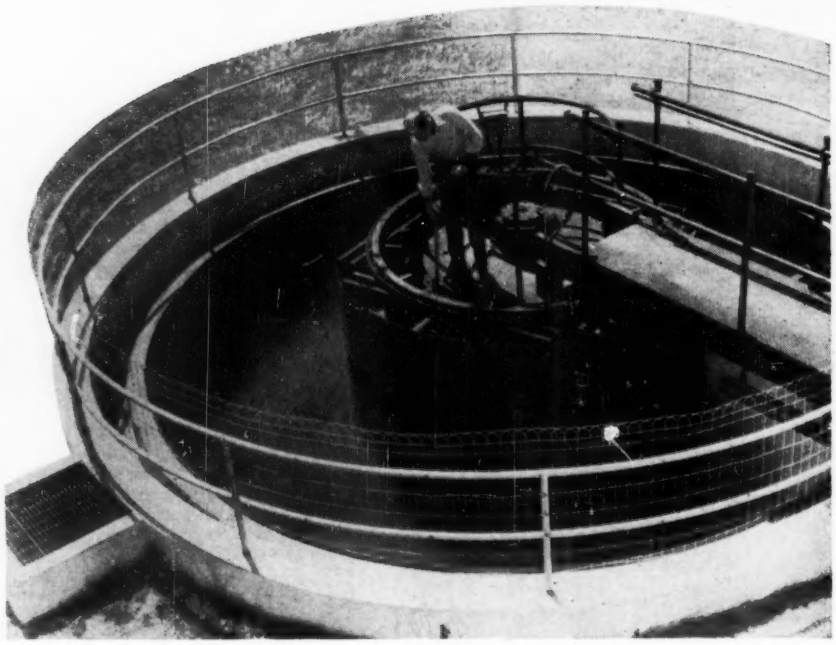
BRANCHES: BUFFALO • CLEVELAND • INDIANAPOLIS • NEW HAVEN

FOUNDRY FACINGS | GRINDING OPERATIONS | BLAST FINISHING | BARREL TUMBLING | METAL CLEANING | POLISHING & BUFFING | AUTOMATIC FINISHING | AUTOMATIC PLATING | METAL RECLAMATION

Metal Finishing equipment and supplies from castings or stampings to finished product.

FREDERIC B.
STEVENS
INCORPORATED
YOUR METAL FINISHING SUPERMARKET
DETROIT 16, MICHIGAN

Disposal of metal finishing wastes—as easy as 1-2-3!

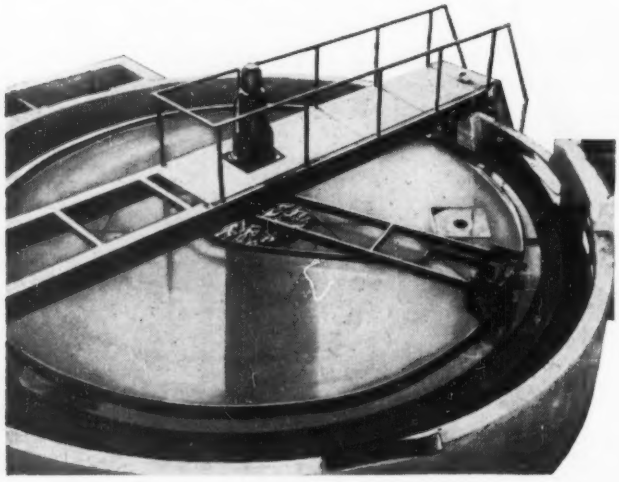


Treatment of pickle liquors, detergents, plating solutions, coolants and rinse waters is rapid and economical when you use INFILCO equipment. One or more of the units shown here will provide a permanent solution for your waste disposal problem.

1. CYCLATOR® Clarifier: A high-capacity unit for removing metals, soluble oils and suspended solids, and for pH adjustment.

2. VORTI-MIX® Circulator: For primary treatment of plating wastes which contain chromates and cyanide. Also applied to pickle liquor neutralization and cracking of oil emulsions.

3. PRIMARY CLARIFIER: For recovery of oil and removal of settleable solids when two stage treatment is required.



The proven success of this equipment in the metal finishing industry is your assurance of satisfaction. See your consulting engineer or write for complete information.

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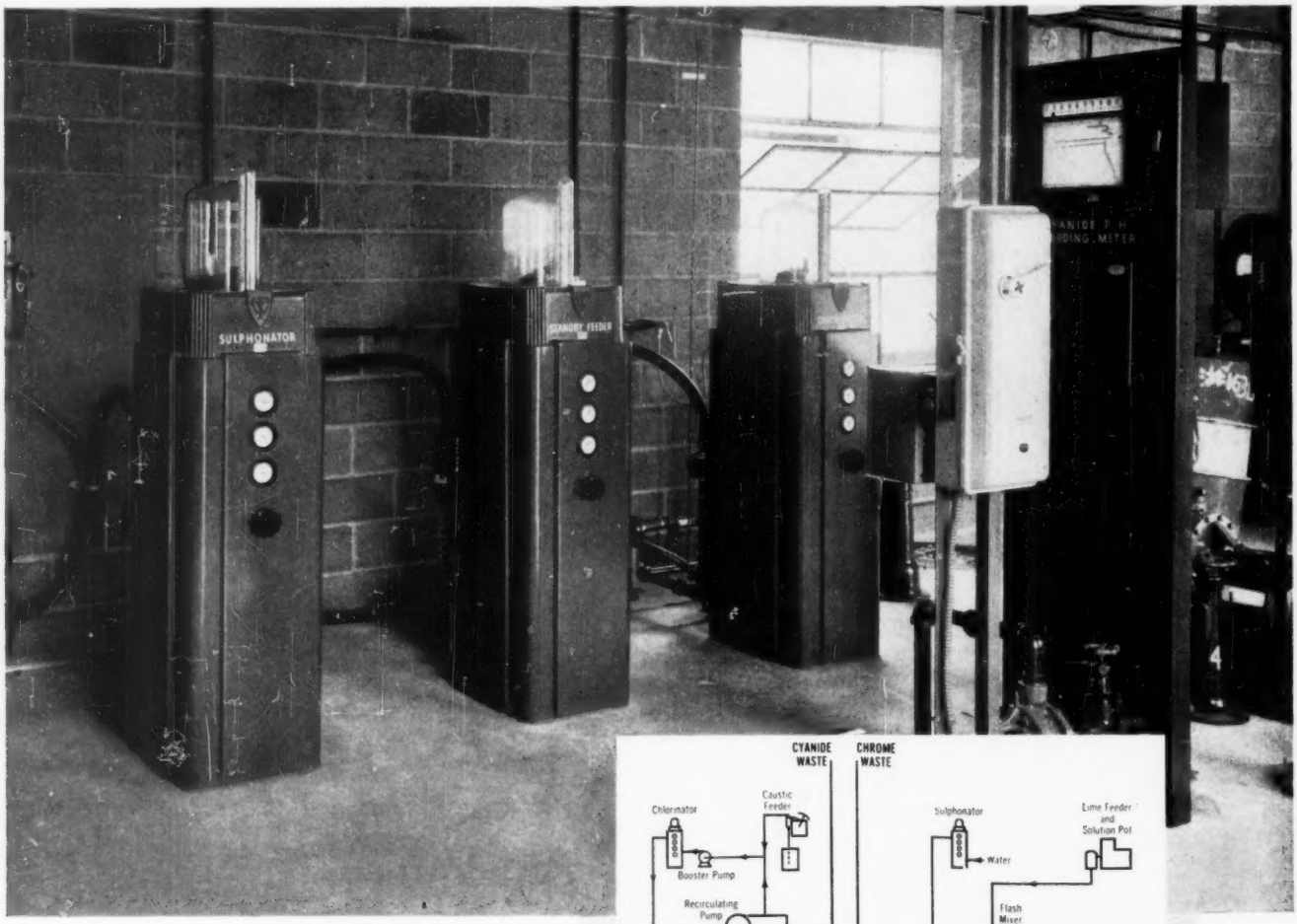
912 South Campbell Ave.,
Tucson, Arizona
Offices in principal cities in North America

INFILCO

The one company offering equipment for all types of water and waste treatment—coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

5522A



TYPICAL TREATMENT FLOW DIAGRAM

DAYSTROM INSTRUMENT DIVISION USES

W&T *Cyanide & Chrome Waste Treatment*

The Daystrom Instrument Division of Daystrom, Incorporated, located at Archbald, Pennsylvania, has provided a compact and efficient treating plant to destroy the toxic components of their plating waste. The treatment plant has been in continuous operation since 1953.

The cyanide bearing waste is treated with chlorine and caustic, using a W&T Water Diaphragm Chlorinator and a W&T Chemical Solution Feeder. The treatment breaks down the cyanide to harmless carbon dioxide and nitrogen gas components.

The chromium bearing waste is treated with sulphur dioxide and lime, using a W&T Sulphonator and a W&T Dry Chemical Feeder. The treatment removes the toxic chromium and other heavy metals from solution, to be disposed of as sludge.

If you would like more information on Wallace & Tiernan cyanide or chromium waste treatment, write for bulletin RA-2120-CM.

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

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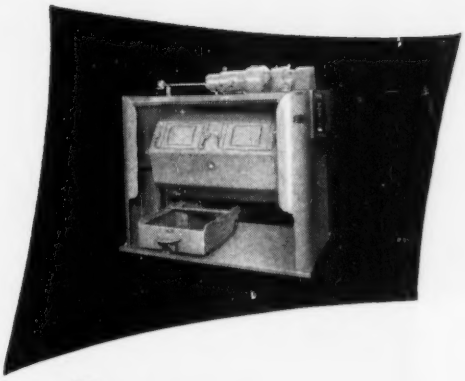
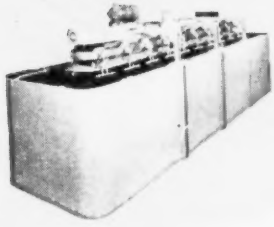


CROWN *equipment*



Automatic Machines for Plating-Anodizing, etc.

Dryers, Centrifugal

Partially Automatic Plating Machines

Plating Barrels

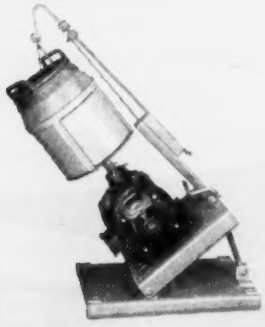
Rectifiers

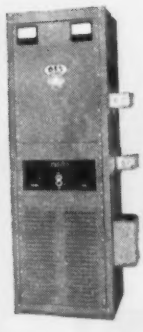
Rheostats, Switches — Controls

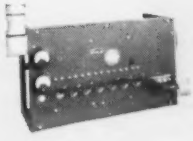
Tray — Transfer Type Cleaning — Rinsing — Dipping Units

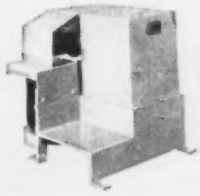
Tumbling Barrels — "Horizontal" — "Tilting"

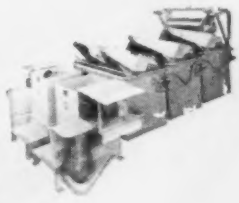
Special equipment designed and built











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Expray-AP

An all-purpose, rust-inhibiting metal cleaner for spray washers

Here's a new alkaline spray cleaner that fills a definite need in metal cleaning. Not just an improved version of cleaners already on the market, Wyandotte's EXPRAY-AP is unique . . . research-developed, proved in use. Here are some typical spray-cleaning applications:

Steel parts — EXPRAY-AP is excellent for removing fabricating soils and preventing rust — even cold in a one-stage washer.

Zinc die castings — EXPRAY-AP is nonetching and provides protection against staining.

Cast-iron parts — EXPRAY-AP removes chips and dust, prevents rust on machined surfaces.

Glass — EXPRAY-AP eliminates streaking, removes pitch, rouge, and oils from lenses and other glass products.

If you're looking for ways to improve your metal-cleaning or finishing operations, call in your Wyandotte representative. Let him show you what EXPRAY-AP can do in *your* plant. Or clip and mail coupon today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, Calif. Offices in principal cities.*

EXPRAY-AP gives you all these benefits — *and more!*

Powerful cleaning action — contains free-rinsing synthetic detergents!

Easy to use — noncaustic, nondusty, free-flowing!

Low-foaming — even at high concentrations and in high-pressure washers!

Prevents scale — even in hardest water!

Prevents rust — contains its own rust inhibitor!

Economical — lower use-cost and reduced equipment maintenance!

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Please send me further information and technical data on EXPRAY-AP.

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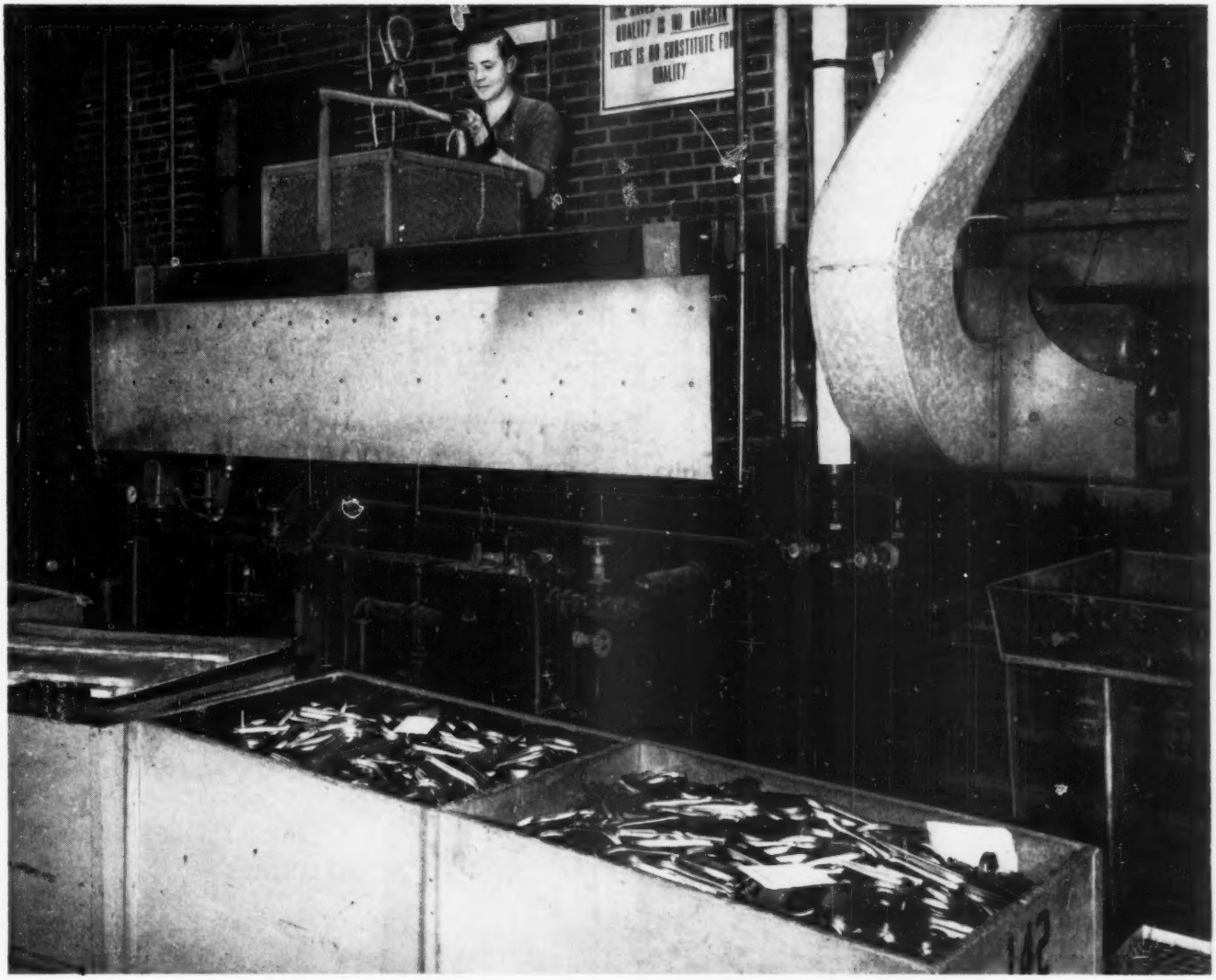

To clean parts for fine finishing

use Nialk® TRICHLORethylene

Fine finishes are achieved only on an absolutely clean surface which provides uniform adhesion during plating or painting. Only a superior degreasing agent, like NIALK TRICHLORethylene, can get metal parts thoroughly free from machining lubricants and foreign matter – can assure the clean surface required for fine finishing.

In addition to its high solvent power, NIALK TRICHLORethylene is recoverable and stable for re-use. This combination of characteristics makes it one of the most efficient and economical degreasing agents available. Whether your requirements are drum-size or tank car . . . for full measure of cleaning power from every gallon, specify NIALK TRICHLORethylene.

NIAGARA ALKALI COMPANY

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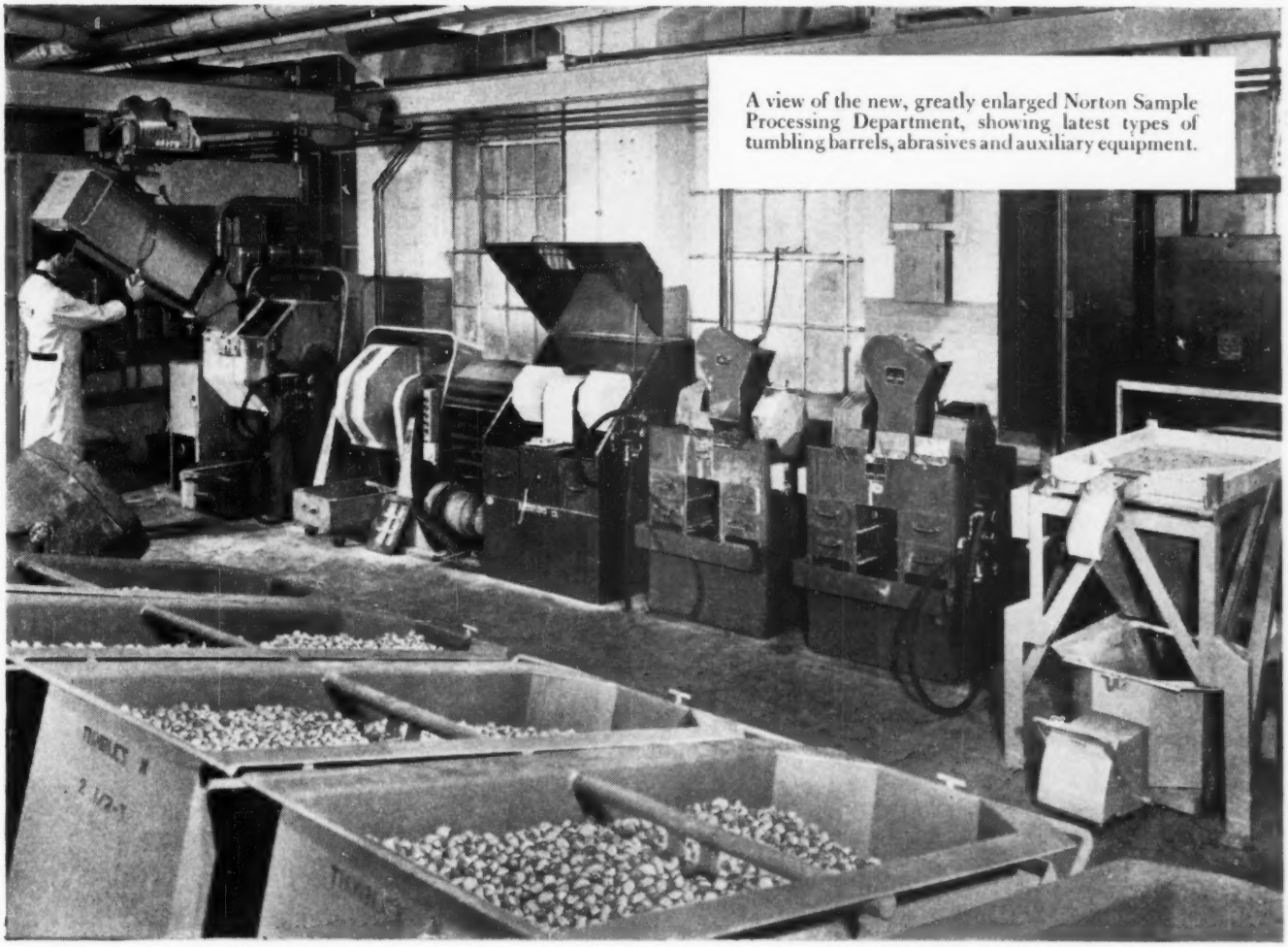
Plant: Niagara Falls, N. Y.

Send for free illustrated booklet, NIALK TRICHLORethylene, containing valuable data on the use and handling of this chemical.



A view of the new, greatly enlarged Norton Sample Processing Department, showing latest types of tumbling barrels, abrasives and auxiliary equipment.

Find out what barrel-finishing can do for you

Make the Norton Sample Processing Department your proving ground for faster, lower cost production methods

If you're still finishing metal parts the long, hard, expensive way — with out-of-date tumbling or off-hand methods — here's your chance to find out how you can improve product quality and cut production time and costs.

The newly enlarged Norton Sample Processing Department puts at your disposal the very latest advances in barrel finishing — including equipment, abrasives and techniques.

Perhaps you'd like to speed up your deburring or descaling operations. You may have complicated parts. You may want to get a better color on your finish, or a lighter cut on die castings so as not to cut under the smooth outside surface.

Whatever your finishing problems, just send us sample parts — and they can range from tiny needles to hefty forgings. Without charge or obligation Norton production engineers will find out just what tumbling will do for you. Your finished parts will be returned along with a detailed report telling you exactly how to get best results from tumbling in your plant. This includes recommendations as to barrel type, size, speed and time cycles . . . type, size and amount of abrasive media to use . . . proportion of compound or cleaner to water, and other data.

What To Send Us

Along with your unfinished parts please forward: (a) a finished sample to be matched (hand-finished if necessary); plus (b) information on your present barrel finishing equipment, if any, including type and size of barrel and speeds. Address the Sales Engineering Department, Abrasive Division, NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

G-300

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JANUARY, 1956 Volume 54 Number 1

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More reports of better chromium plating

Here are plants' experiences with deposits from Unichrome SRHS Solutions*

Companies using both SRHS Chromium Solutions and ordinary chromium have had an opportunity to compare results. Substantial differences have been reported.

BETTER COLOR NOTED

One plant of a well known company was using ordinary chromium over an ideal nickel surface. Another of this company's plants wasn't getting the best nickel deposit possible, but still its chromium plating had brightness superior to that of its sister plant. The second plant ascribed the difference to the SRHS Chromium being used in its tanks.

MINIMIZED REJECTS REPORTED

At one company, intricate parts were causing chromium plating difficulties. On occasion, rejects ran as high as 25%. Yet when the SRHS Chromium Solution was used, deposits covered beautifully and work was plated at a reject rate of no more than 0.4%.

UNUSUAL WEAR RESISTANCE FOUND

A large tool company chromium plated punches used in the manufacture of nuts. Various chromium solutions were tried. They reported that while ordinary chromium doubled the output from punches, deposits from SRHS Chromium tripled it.

All these reported "deposit-advantages" are in addition to the many thoroughly confirmed operating advantages of SRHS Chromium baths. These include plating with higher cathode efficiency, greater speed, a saving in power, and self regulation of important bath constituents.

Platers not using Unichrome SRHS Chromium will find it to their advantage to get the facts by writing United Chromium.

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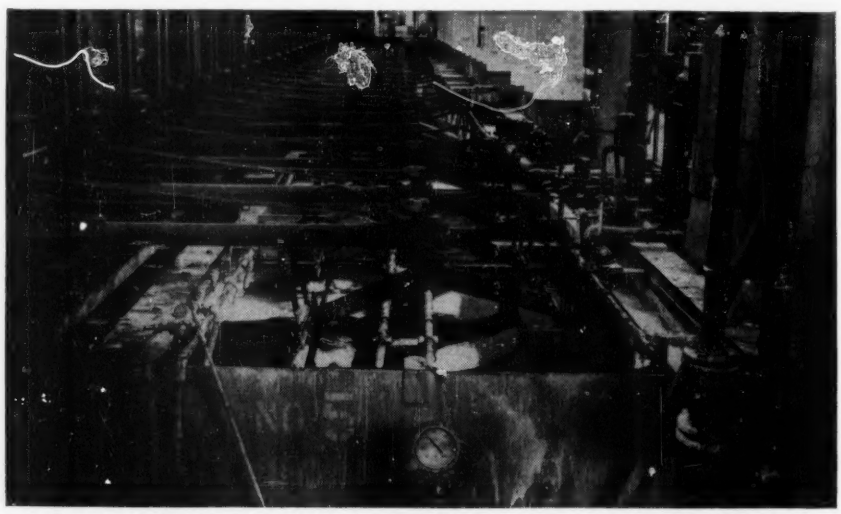

Performance of SRHS Chromium Solutions has resulted in their extensive use by major plating plants.

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Unichrome Copper, Unichrome Bright Nickel and SRHS Chromium are so thoroughly suited to each other, they represent something unique in finishing. They're the first matched set developed exclusively by one company. Used together, they add up to more advantages than the sum of their individual benefits.

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Unichrome Pyrophosphate Copper contains no cyanide, saves disposal costs, and reduces or eliminates much buffing expense.

Unichrome Bright Nickel cuts downtime for purification, has unusual operating stability.

When both of these processes are used along with SRHS Chromium, benefits begin to multiply. The copper proves active for the nickel. In turn, the nickel shows unusual receptivity for the chromium. Passivity problems are eliminated. Downtime drops, rejects become rare.

Moreover, service responsibility rests with one source, assuring prompt technical help and a smooth running operation.

Bulletins supply details on each of the processes. Send for them.

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METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

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The Outlook for 1956

January is the time for forecasts and a brief glance at what is in store for the metal finisher is in order at this time.

As regards supplies, equipment, chemicals, and most materials, the prospects appear very favorable, barring strikes such as those in the copper industry last year, which seriously affected the balance between supply and demand for a while. This editor has expressed himself before on the advisability of maintaining sufficient inventories to avoid hardship due to unforeseen developments, and the prospects for easy supplies haven't caused him to change his opinion one bit.

Lead, zinc, cadmium, silver, tin, and copper should be readily available, but pressure which was evident last year may result in higher prices. Copper consumers will be better off to the extent of 14,000 tons during the first quarter as a result of government diversion. Platers are consuming nickel at the rate of about 2,500,000 lbs. per month and industry's stocks are at about their lowest level since the Korean War. Although no nickel has been released from the stockpile, the government has diverted to industry some of its deliveries, giving slight respite to consumers. During the first quarter of 1956, a total of 4,100,000 lbs. will be made available to users each month in this manner and, as was the case for the nickel diverted in November and December, this will be premium priced metal. These diversions will only slightly more than offset an expected increase in defense orders requiring the use of nickel and, since platers account for about 10 per cent of consumption, any relief will be insignificant. Despite continually increasing production of nickel, the earliest forecast for ready availability to all is 1958. Until then the situation will remain critical.

Business, in general, continues at a high level and contract finishers in many parts of the country have started to raise prices across the board between five and ten per cent, as the effects of increasing labor and material costs in 1955 begin to stand out in the balance sheets. In this highly competitive area of the industry such actions are not taken without serious soul-searching. However, the step was long overdue and the job platers will be in much healthier conditions, as a result.

The consensus would indicate that another fairly normal year lies ahead of us, especially if international relations continue to improve.

Nathaniel Hall

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Technical Developments of 1955

By Nathaniel Hall, *Technical Editor*

Cleaning

ATTEMPTS to place the *evaluation of alkaline cleaners* on a really scientific basis appear to be nearing the desired goal as a result of the recent availability of radioactive chemicals. Two excellent articles were presented on the subject, one by Hensley & Ring[1] who studied the effect of *changes in electrocleaning variables* on the removal of radioactive tagged soils, and the other by Bulat[2] who used such soils to evaluate the *efficiency of various cleaning methods.*

Other studies included one by Linford[3] on the correlation between *spreading rate of various solid fats and oils* on a metal with the cleanability, and another by Osipow, Pine, Snell & Snell[4] *comparing diphase cleaners with alkaline soak cleaners* for removing greasy soils. Since, contrary to standard practice, no wetting agent was added to the soak cleaner, the diphase cleaners appeared in a better light, although detracting from the value of the study.

Among the descriptive items worthy of note, were the *use of ultrasonics* to improve cleaning efficiency by Hightower,[5] a discussion of which *chemicals and processes* to use by Mohler,[6] and a quite valuable contribution, by an ASTM committee, on the *principal items of expense* in metal cleaning procedures.[7]

Patents consisted of an *emulsion cleaner* formulation claimed by Holman,[8] and *spray washing machines* disclosed by Kearney & McPhee,[9] Kearney,[10] and Brucker.[11]

Solvent degreasing developments during the year were quite lacking, the literature disclosing but one article, by Morris[12] on the *use of ultrasonics* for removing adherent dirt, and three patents on *equipment*, granted to Kearney,[13] Lueck[14] and McAlister.[15]

In the field of abrasive blasting also, only one article was worthy of note, a description by Ehlert, Kaufman & Burrett[16] of *liquid honing* as a surface conditioning operation. However, improvements in blasting equipment accounted for a number of patents. *Nozzles* were patented by Myers[17] and by Kirkland,[18] *machines* by Moore[19,20] and by Oddie,[21] and *portable abrasive blasting* units by Crowe[22] and by Hastrup & Pinkerton.[23]

Pickling

Pickling of metals was a very active subject during the past year, with emphasis on treatment of spent pickling solutions, covered in another section of this report. Surprisingly, only one new inhibitor was disclosed, *tincture of iodine*, in a patent granted to Hager & Rosenthal[24] and only one article, by Carroll[25] appeared on the *role of inhibited acids* in electroplating cycles.

A comparison of 10% sulfuric acid with 20% muriatic acid as a pickle for mild steel indicated that the rate of attack was far greater for hot sulfuric than for cold muriatic. The authors, Jackson, Stedman & Riley,[26] also investigated the *effect of previous alkaline cleaning* on pickling rate. A number of general articles would be considered of interest. Fishlock[27] reviewed the different *reagents and processes* available for various common metals, Gardner[28] presented a short survey of *techniques* for pickling iron and steel, and Risher[29] described proper *handling devices* for batch pickling. Continuous pickling of *stainless steel* was detailed by Jaray[30] who pointed out the effectiveness of plastic materials of construction, while sodium hydride formed the basis of a process patented by Carter[31] for *continuous strip treatment.*

Treatments for specific metals included a description of satisfactory *procedures for titanium* by Starr[32] and a discussion of *hydrogen adsorption* in the sodium hydride process for this same metal by Barth & Feild.[33] Scale removal from *titanium* with 60% hydrofluoric acid was claimed in a patent issued to MacPherson.[34] Other developments consisted of a paper on the preparation of *beryllium copper* for production of adherent electrodeposits, presented by Morana[35] and two patents, to Fernsler & Tschop on a *molten salt bath* containing sodium fluoride and carbonate for heat and corrosion resistant alloys,[36] and to McDonald & Hawley[37] on an *etch for aluminum* prior to spot welding, consisting of phosphoric acid, a sequestrant and an aryl-sulfonic acid.

Polishing

MECHANICAL

Although 1954 was a banner year in this phase of finishing, it was surpassed by 1955 and, again, the activity was mainly in the patent disclosures. The most important report was by Westman & Mohrnheim[38] on the *influence of the physical metallurgy and mechanical processing* of the basis metal on electroplating. The other two articles culled from the technical press consisted of a description of *tripoli as a polishing abrasive* by Badaluco[39] and a discussion of the *ABCs of polishing and buffing* operations for aluminum, by Keating.[40]

Improvements in buffing wheels and buffs were many. Lotz[41] claimed a *glass cloth buffing wheel* and other originals were disclosed in patents granted to Field,[42] Lyon,[43] Peterson,[44] Davies,[45] Upham,[46] Myer,[47] and Churchill.[48] Rotary *brushes and abrasive heads* were the subjects of patents issued to Peterson,[49,50,51] Nielson,[52] Landau,[53] Swan,[54,55] and to Klug.[56]

Although not one article was noted on belt polishing

practice, this subject was covered in an exceptionally large number of patents. *Abrasive belts and equipment* were patented by Storrs & Wells,[57] Lindenberg,[58] Orr,[59] Anderson,[60] Carlson,[61] Thiel,[62] Krafft[63] and Smedley.[64]

Buffing and polishing *machines* were the subjects of patents granted to Sherrill & Massey,[65] Dackor & Nelboeck,[66] Kinker & Murtagh,[67] Murray,[68] Kinker,[69] Brown[70] and Thiel.[71]

Electrolytic

Lorking accounted for much of the development work reported in this field, publishing a study of the *optimum conditions for Nimonic 80* (nickel alloy plus 18% chromium) in mixtures of sulfuric and phosphoric acids,[72] and an investigation of sulfuric, phosphoric and water for *chromium and its alloys*.[73] In this latter paper the author suggested a probable mechanism for electropolishing. Another study by Lorking of the influence of surface active agents on the *treatment of copper* in phosphoric acid solutions[74] indicated that cetyl trimethyl ammonium bromide improved the results.

In other articles, Steer discussed the effect of electropolishing on the *fatigue limits* of highly stressed parts and methods of reinforcing surfaces weakened by electropolishing;[75] Mondon[76] described the *characteristics of the polished surfaces* and some successful applications in industry; and Brace[77] reviewed the electropolishing and chemical polishing of *aluminum*. An *electropolishing solution for aluminum*, patented by Turner,[78] consists of sulfuric and phosphoric acid with the addition of aliphatic polyalcohols or ether alcohols. Other solutions claimed in patents were an acid solution containing thiourea for *gold and its alloys*, disclosed by Reichert,[79] and a similar solution for gold, with the addition of one of the alloying elements in the form of a salt, claimed by Fischer.[80] A *process for copper*, employing copper nitrate and sulfuric acid, requires a minimum of 3,000 amp./sq.ft. according to Strobel.[81] Other electropolishing patents consisted of *equipment* in which a progressively increasing area of anode is exposed as the article advances, invented by Gray,[82] a continuous *method for filaments* disclosed by Murray,[83] and a continuous *method for tapes* granted to Strobel.[84]

Chemical

As usual, aside from an experimental study of *peroxide-oxalic acid mixtures* by Hickling & Rostron[85] to define the conditions, in which the authors developed a theory to explain the action, and a patent on acid solution of fluoride, nitrate and fluosilicate for *zirconium* granted to Beach,[86] chemical polishing, or, bright dipping as it is more familiarly known, of *aluminum* held the spotlight. We have previously mentioned the article by Brace.[77] In addition, an article by Pinner[87] discussed the practice, in this connection, of the *automotive industry*. Three new solutions were claimed in the patent literature. Jumer[88] described a hot solution of *phosphoric acid containing sodium nitrate and sodium sulfate*, Murphy[89] disclosed a solution of *nitric acid and fluoboric acid* containing a small amount of copper, and Hesch patented a hot solution of *nitric acid and ammonium fluoride*, also containing a small amount of copper.[90]

Barrell Finishing

Despite the generally held impression that barrel finishing is a matter of trial and error, there are a number of basic features which, if understood, can simplify the determination of suitable processing cycles for any particular articles and metals. Therefore, it is not surprising that articles on this subject are on the descriptive side rather than on the theoretical or scientific. *Methods, troubles and cures* were considered by Feldmann,[91] while Mable[92] discussed practical methods for grinding and burnishing various metals, covering *types of barrels, media and plant layout*. An article on the *development and technique* of barrel finishing was of unusual interest because the author, Kellar, included a bibliography of early British patents.[93] Other descriptive articles covered *wet tumbling methods*, presented by Arensten,[94] and *deburring* of small machined components, described by Bryan.[95]

Only two patents were noted, Vincent claiming an *oblique multiple tumbling barrel* apparatus,[96] and Bell a *drum for descaling wire* by ball tumbling.[97]

Aluminum Plating and Anodizing

Aluminum coatings, especially anodizing, has occupied the researcher to an extent unequaled by any other single finishing process in recent years and, each year, we are fortunate in obtaining from the laboratories some new basic findings of value. Last year the honors could be shared equally by two investigators. Spooner,[98] working with *high purity aluminum* in sulfuric acid baths, determined the coating weight, metal loss, coating ratio, sealing weight gain, dyed color density, and coating chemical dissolution rate. Mason[99] studied *oxide coatings* from the same sulfuric acid bath, finding them to be practically anhydrous but always containing an appreciable amount of combined sulfur.

In other articles, Brace[100] discussed recent research on the *mechanism of film formation*, anodizing conditions and practical implications, while Wernick & Pinner[101] detailed the *theory, types of processes and mechanism of film growth*. These authors also surveyed in complete detail the whole field of *industrial anodizing*[102] and *hard anodizing*.[103] Another survey describing anodized coatings, what they are, and how they behave, was presented by Cohn.[104]

On the practical operational side, McNeill[105] detailed the use of *bipolar electrodes* for anodizing hollow objects of aluminum and magnesium. In an article mistitled "barrel" anodizing, Etienne[106] presented the first really detailed account we have seen of *basket anodizing* technique. Equipment was the subject of one patent, granted to Backer[107] on a centrifugal apparatus for *anodizing zippers*, while two patents were issued on processes, one to Hesch[108] on a solution of phosphoric and sulfuric acids for *production of clear coatings*, and the other to Axtell[109] which involved anodizing for a short period in a *0.3% solution of chromic acid and 1.68% phosphoric acid*, then dipping in an organic finish without prior rinsing or completely drying the surface.

Plating on aluminum appears to have narrowed down to the zincate process and practically nothing important was disclosed during 1955. Wernick & Pinner[110] reviewed the various processes available

emphasizing, as would be expected, the *zincate method*. Hafer[111] pointed out the *importance of careful preparation* to obtain sound and adherent deposits, and one patent, issued to Ihrie & Root,[112] claimed a method of *cadmium* on aluminum with the zincate process of preparation.

It would be wonderful if aluminum could be electrodeposited from aqueous solutions, but the outlook is bleak. Almost each year, however, a small amount of attention is given the non-aqueous baths and last year was no exception. Heritage studied the three *organic type baths* found suitable[113] and decided that the hydride bath is most promising, while Hansgirg disclosed a method for producing high temperature- and corrosion-resistant *coatings on molybdenum, tungsten, and their alloys* by deposition of aluminum from a molten bath.[114]

Aside from the above, the field was preempted by hot-dip processes, which may be considered the only present commercial method of coating metals with aluminum. Hughes & Thomas[115] reviewed the *applications of aluminized steel* prepared by various processes, Westerman described the *continuous coating of iron and steel wire*,[116] and Hughes[117] discussed the *preparation of the steel*, in addition to the properties and uses of the coated product. Patents consisted of a machine for *continuous coating of wire and strip*, claimed by Whitfield;[118] an *aluminum coating on steel* characterized by intermediate layers composed of iron, aluminum and titanium or zirconium, disclosed by Lundin;[119] and two *fluxing processes*, to Westby[120] for an aqueous solution of zinc chloride, lead chloride and muriatic acid, and to Legg[121] who coated the steel with a *hydrocarbon wax* which would burn at the pot temperature to produce a reducing atmosphere.

Metallic Coatings

Nickel

The relatively slighting treatment received by nickel in the technical and patent literature during the year leads one to wonder whether there is any connection with the nickel shortage. Only one *nickel brightener* was patented — acetylenic compounds, disclosed by Kardos, Menzel & Sweet,[122] and only one author concerned himself with bright nickel plating. Such describing the choice, control and operation of various *bright solutions*[123] and listing the advantages and disadvantages of bright as compared to dull nickel from a practical standpoint.[124] Young & Strobach,[125] in an investigation of nickel and cobalt *deposition from fluoborate baths*, looked into the matter of bright deposits during the course of their work.

Etching of steel prior to nickel plating to insure adhesion was covered in two articles and one patent. The most interesting was a report by Brune & McEnally[126] on the use of an *anodic etch* in a sulfuric acid-Epsom salt bath instead of the usual straight sulfuric acid. The advantage is that a current density of only 25 amp./sq. ft. is required as against 200. The others consisted of an outline of *processing bumper bars* in which a *nickel strike* was employed by Weinberg & Lake[127] instead of the conventional copper strike, and a patent in which Prine[128] claimed a process for *anodic pickling and nickel plating* the interior surfaces of steel tanks, using the Watts type nickel bath for both purposes.

The uses of nickel deposits and their properties were described in three articles. Moeller & Snell[129] applied a *diffused coating of cadmium on nickel* for high temperature jet engine use, Oswald[130] reviewed the *properties and uses of heavy nickel deposits*, and Mohler surveyed the *basic bath formulas* and modifications[131] used in applying nickel deposits for engineering applications.

The furor over *electroless nickel* has died down but the process has found its niche and a moderate amount of activity was shown in the literature. Chinn pointed out what the process can do and where it is being used,[132] while patents included a method for *coating hollow containers*, claimed by Talmey & Crehan;[133] a *dilute one-shot solution* which turns from green to colorless, indicating, according to Jendrzynski & Stapleton,[134] complete depletion of the nickel; and the improvement in operation disclosed by Spaulding,[135] which consists of *removal of phosphite by-products* by anion-exchange. Deposition on *non-conductors* was studied by Pearlstein,[136] who found that the surfaces could be activated by a *palladium chloride dip*, and by Eisenberg & Schneider,[137] who seeded *ceramic surfaces* by soaking in hot concentrated sodium hypophosphite solution prior to plating.

Chromium

A number of interesting investigations were reported, both on chromium baths and on deposits. In connection with the former, Rousselot[138] suggested a *standardization of bath tests*, using a bent cathode in the Hull cell to study the covering power under simple operation conditions. Gabrielson, using ion-exchange to study *complex ions*,[139] found that positively charged complexes are formed in the bath between trivalent chromium and dichromate ions.

Based on an investigation of *cracking in chromium deposits*, Fry[140] tentatively suggested that this may be due to reduction in tensile strength associated with structural abnormalities in the region of the striations. Williams & Hammond[141] examined the *effect of chromium plating on fatigue strength*, confirming that there is a reduction if the article is heated below 300°C. after plating, but heating at 440°C. is beneficial. *Fatigue strength* of hardened steel, as it is affected by *different types of chromium deposit*, was reported on by Stareck, Seyb & Tulumello.[142] A proprietary bath, in which the authors are interested, showed up well, which did not surprise this reviewer.

Recent *developments in chromium plating* were detailed by Silman,[143,144] including new types of solutions and different processes, and an *electroless chromium* plating process, similar to that for depositing nickel, was suggested by West.[145] The patent literature disclosed a *trivalent chromium plating solution* containing urea, claimed by Yoshida;[146] a method granted to Scanlon[147] for production of chromium coatings on *copper infiltrated iron powder compacts* for corrosion resistance; a process for plating bright chromium on a *bright antimony surface*, disclosed by Karash;[148] and a process invented by Eyerund,[149] in which hard chromium is applied *directly to aluminum* by first applying a thin layer of a metal which is dissolved in the chromium solution, followed immediately by chromium plating.

Copper

Continuing the trend evidenced during the previous year, and possibly also due to the nickel shortage, there was a moderate amount of activity in the field of copper plating. Wilhelm & Kayser report their work on the measurement of *current distribution in acid copper plating solutions*, using a probe electrode.[150] After investigating *stress in deposits* from the acid sulfate bath, Sadek, Halfawy & Abdu[151] reported that the stress increases with current density up to 2 amp./sq. dm., and explained this as due to increase in density of the deposit as it grows in thickness. Nevers described the *effect of anode composition*, especially the addition of phosphorus. in acid copper plating,[152] and Safranek & Faust[153] discussed their study of *anodes made from OFHC (oxygen-free-high-conductivity) copper*, which indicated that less sludge was formed in both acid and cyanide baths.

Two *immersion copper processes* were patented, one to Kantrowitz & Yelmgren on a copper sulfate bath, containing pyrogallol and neutralized with ammonia,[154] and the other to Meth[155] for the production of *copper-backed silver mirrors* by cementing out of a copper sulfate solution. Only one *brightener for cyanide solutions* was patented, Wernlund[156] claiming a selenium compound and a naphthalene sulfonate with periodic reverse current. Four patents were granted, however, on *brighteners for acid baths*, to Jernstedt & Ceresa,[157] to Pierce,[158] to Brown & Fellows,[159] and to Hoover.[160]

Other Metals

There were practically no developments in *cadmium and zinc plating*. Millward[161] described a high speed plating cycle for these metals, and *salt spray tests* by Wolff[162] indicated that the former stands up exceptionally well. This study included chromate films, formation of spots, and flaking of the deposit. The patent literature disclosed only a *fluoborate cadmium bath* containing an enzyme, claimed by Alexander,[163] and a novel method of *coating by impact*, in which Pottberg & Clayton[164] tumbled the articles with zinc-coated shot and powdered zinc.

There were two investigations of *tin plating from the acid sulfate bath*. In one, Discher[165] attempted to determine the role of various properties of the bath, containing addition agents, on the cathode deposit. In the other, Discher & Mathers[166] discussed the role played by a number of *addition agents*, together with the concentration, operating conditions and properties of the deposits. The *fluoborate tin bath* and addition agents for same were described by Mohler[167] and a continuous wire plating line, using this solution was detailed by Carlson.[168] *Removal of tin deposits* from copper base alloys was the subject of an article[169] and a patent, granted to Bauch on the use of a dilute sulfuric acid solution containing copper ions.[170]

Precious metal plating was another field about which the literature was quiet. Sloane & Cross[171] listed the advantages which make *precious metal deposits* desirable in industry. Parker described the factors affecting *deposition of rhodium* in flash and heavy layers, the effect of impurities and purification methods,[172] and Suchoff was issued a patent on an *immersion rhodium bath* for copper printed circuits.[173] Silver was the subject of one article in which Toth & Ricks[174] detailed the procedure for *plating aluminum bus bars*, and one patent in which Lukens[175] disclosed the production of *non-porous silver deposits* by applying a fused insoluble silver salt to the deposit.

On the subject of other metal deposits, the technical literature offered only a study of *lead phenolsulfonate baths* by Gatos & Mathers,[176] who found that the best addition agents were p-cresol, goulac and aloin residue, and a paper on the *deposition of titanium* from fused salt baths of sodium chloride and potassium titanium hexafluoride, from which Sibert & Steinberg claimed to have obtained adherent deposits up to 0.005 inches thick.[177] All other disclosures were in patents.

Antimony deposits were claimed by Karash[178] from a bath containing an aromatic sulfonamide, by Burnside from a solution of *antimony trichloride, sulfuric acid and hydrofluoric acid*,[179] and by DuRose[180] from an *acid trifluoride bath* containing an aliphatic alpha hydroxycarboxylic acid. *Iron baths* were claimed by Meyer[181] and by Harr,[182] the former for an alkaline solution containing an organic amine and EDTA, the latter for an *acid solution of ferrous ammonium sulfate* with a small amount of ammonium fluoborate to prevent formation of slimy precipitates.

The patent literature accounted for a patent granted to Dean[183] on *deposition of manganese* from a strongly ammoniacal solution, one to Senderoff & Brenner[184] on *molybdenum* from a potassium hexachloromolybdate bath containing a halide and operated in an inert atmosphere, one to Wainer[185] on *titanium* from a fused alkali metal halide bath containing fluotitanate and titanium monoxide, and one to Kendall & Kusa[186] on *lead immersion coating* of steel, in which the dissolved iron is oxidized and precipitated by addition of fluoride.

Alloys

It is gratifying to see the developing interest in deposition of alloys since it is in this field that scientific research can tap much virgin territory. *Recent additions* to the group of alloys which can be plated out were discussed by Lowenheim[187] in an article which can be recommended as a starting point. Research reports were presented on a number of uncommon alloy deposits. Ernst, Amlie & Holt[188] obtained alloy deposits of 20-50% *molybdenum with nickel, cobalt, and iron* from solutions containing sodium molybdate, sodium citrate, ammonia and a sulfate of the alloying metal. Citrate baths were also employed by Hoar & Bucklow[189] to deposit *tungsten cobalt* alloys, deposits of 60-66% tungsten being obtained with pulsating direct current. *Iron-zinc* alloys, deposited from chloride sulfate baths by Jepson, Meecham & Salt,[190] were found to have some interesting properties, such as better corrosion resistance for the 30-90% Zn alloy than pure zinc. Unfortunately, the process required dual anode circuits.

On the subject of *brass*, Roehl, Michel & Westbrook[191] described a *high speed bath* using copper-zinc ratios of 10:1 to 20:1 and temperatures of 165-200° F. Feldman[192] listed the *troubles experienced and cures*, with surprisingly old-fashioned suggestions like ammonium sulfate to correct the pH and provide ammonium ion for color. Lowenheim[193] pointed out the advantages of *copper alloyed with about 10-12% tin*. Mohler[194] reviewed the *copper-tin-zinc baths*, their compositions and the characteristics of the deposits

therefrom, and one patent was issued to Heymann & Schmerling on a cyanide-caustic-citrate bath for *copper-tin alloys containing aluminum or magnesium* and operated with alloy anodes,[195] and another to Chester on the addition of dithiobiuret to extend the current density range of *white brass* solutions.[196]

Lead alloys were covered in two articles and two patents. By periodic current reversal, employing an apparatus based on the commutator principle to produce a square wave a.c., Hovey, Griffin & Krohn[197] were able to eliminate nodule formation during *deposition of lead-copper alloys* from the cyanide-tartrate bath. Putnam & Roser[198] used hydroquinone and lactalbumin peptone as addition agents in a fluoborate bath to deposit bearing metal alloys containing *lead with 11% tin and 7% antimony*. The patents consisted of an alkaline tartrate bath for deposition of *12% antimonial lead alloy* on copper wire, claimed by Faust,[199] and the production of *bright lead-zinc coatings* (0.5-4.0% Zn) for which Beach employed a cyanide-tartrate bath.[200]

The *corrosion resistance of tin alloy deposits* was emphasized in three papers. Gore covered *tin-nickel* coatings,[201] while Britton & Stacpoole indicated that *tin-cadmium* deposits on steel were inferior to cadmium in inland urban atmospheres, although good in laboratory corrosion tests.[202] These same authors also presented the results of *comparative corrosion tests*, both atmospheric and accelerated, on steel coated with zinc, cadmium, and 80-20 tin-zinc alloy in contact with aluminum,[203] which indicated the alloy deposits to be the most useful general purpose coatings.

Two patents were granted on *gold alloys*, one to Spreter & Mermillod[204] on a bath containing aurocyanide and an organo compound of the alloying metal, the other to Campana[205] on a *bath containing palladium* and at least one metal from the group consisting of copper, nickel, and cadmium.

Metallizing — Vacuum and Vapor Processes

The furor over electroless nickel deposition died down last year but procedures for the application of this process to non-conductors was reported in two papers already discussed in a previous section of this review.[136,137] A review of the literature by Wein[206] included the *plating baths* employed for deposition on metallized non-conducting surfaces, while Keating[207] described *methods of cleaning and roughening*, in addition to metallizing and plating. Metallizing of non-conductors was claimed in three patents, one to Bergstrom[208] disclosing a method consisting of soaking in stannous chloride, then dipping in *palladium chloride*, followed by immersion in a solution of the metal to be deposited. The other two were *hot methods for ceramics and glass*, Barnard & Buckley[209] claiming the application of a metal oxide, which is heated to fusion and then reduced to the metal, while Bosch[210] disclosed the *application of a silicate* followed by a molten metal from the group of indium and its alloys.

Eltcroforming was the subject of a paper by Rice[211] which discussed the production of parts of high precision, complex internal design and exceptional surface finish or detail using various metal electrodeposits. In another paper on the use of *electroforming in electronic engineering* and methods of application, Walker, Bentley & Hall[212] stated they had found that *carbonate content of silver cyanide solutions* had no effect on stress. *Low stress nickel deposits* could be produced by superimposing a.c. voltage of a peak magnitude about three times the d.c. voltage, according to claims of Marchese[213] in a patent on a method of producing electroforms. Other methods claimed in patents were for manufacturing *forming dies*, granted to Lindbom,[214] *printed circuits* described by Nieter,[215] and *fine mesh metallic screens*, disclosed by Donohue & Rennie.[216]

As in the case of electroless nickel, *vacuum metallizing developments* were quite meager, consisting of one article by Weil,[217] which was a review of the general techniques but contained an excellent explanation of the mechanism of formation of the film, and two patents, in one of which Clough & Godley claimed a *carbide wick element* for evaporating the aluminum,[218] and in the other Auwarter claiming a process for applying first copper, then silver to *nonconductors*.[219]

Gas plating, in which a volatilized metal salt is decomposed on the surface of an article at high temperature, was not covered in any articles but a number of patents dsclosed inventions based on the process. Two were on new apparatus, for *carbonyl gas plating* claimed by Pawlyk[220] and for plating dielectric disks covered by Schell.[221] One patent, also to Pawlyk, was on the *production of nickel foils* by decomposing nickel carbonyl[222] and another, to Schladitz[223] involved *spraying* jets of the decomposable metallic compound onto the heated surface. Preheating the base metal in order to produce *copper coatings* was disclosed by Pawlyk,[224] who also claimed the use of *copper acetylacetonate* in another patent.[225] Other inventors claimed new processes, includng Castor[226] for a mixture of *iodine and an ester* of a polyvalent metal, with the additional step of heating until the coating metal was fused to the base; Stauffer[227] for a *powdered solid metal carbonyl* from Group VI of the periodic table; and Wainer & Kempe[228] for the *protection of molybdenum* from corrosion and high temperatures by coating with silicon reduced from *silicon tetrachloride* vapors.

Conversion Films — Corrosion Preventives

In the broad area of conversion coatings, the field was shared almost equally by chromate and phosphate processes. There appears to have been no slackening of interest in the subject and research laboratories continue to produce improvements in what could almost be considered a perfect process.

As regards review articles, Cavanagh & Gibson[229] covered the *phosphate process* in a survey which would have been more valuable had the advertising been omitted, while Pocock[230] limited himself to the *chromate films* on the common metals. Hardouin[231] attempted to evaluate the *newer methods for coating magnesium* against the older ones, and Wernick & Pinner[232] detailed the different *processes for aluminum*.

In the research department, McNeill described a new *electrolytic coating for magnesium*[233] from an alkaline ammonium chromate-phosphate-fluoride bath, which had the advantage of short treatment time and inexpensive electrolyte but required a very high voltage. Ogburn, Salmon & Kronenberg[234] investigated the most suitable types of electrolytic processes for

magnesium, finding that the *low-voltage alkaline chromate process* compares very favorably in its protective value. Lastly, Gilbert, Eisler, Doss & McHenry determined experimentally[235] that approximately 89% of the phosphate film remains on steel during *cold extrusion* of artillery shells.

Chromate films were disclosed in two patents, Chester[236] claiming a solution of chromate, nitrate and fluoride for *zinc*, and Deer[237] a solution of chromic acid and alkali sulfate for *aluminum*. Phosphate films were covered in four patents. One, to Hyams & Nickolson[238] covered a *phosphating solution containing hydroxylamine;* another to Miller[239] disclosed a dry compound prepared by mixing anhydrous sodium acid pyrophosphate with phosphoric acid: a third to Russell[240] claimed a *combination cleaning and phosphating composition* consisting of an alkali metal phosphate, an oxidizing agent and an alkali metal lignosulfonate; and the fourth, to Evangelides. on the well known HAE electrolytic process for magnesium, employing an alkaline *manganate-fluoride-phosphate* bath.[241] Baxter completes the list of conversion coating patentees with one on a *sulfide coating for stainless steel* from an acid solution of sulfide and fluoride.[242]

Tarnish and corrosion preventive *wrappers and chemicals* were covered in five patents. Renold[243] protected silver by impregnating a *cloth with a silver compound* and received a patent on the process, while Marshall & Bennett[244] covered a *wrapper impregnated with basic copper carbonate. Volatile corrosion inhibitors* took care of the other three. being covered by Wachter with Skei,[245] with Moore,[246] and with Stillman.[247]

The expected number of patents on *hydrocarbon and other organic films* were noted during the year. These were received by Fales,[248] Fields,[249] Michel & Hager,[250] Hughes & Lembcke,[251] Jolly,[252] Paxton,[253] Rudel & Gargisa,[254] Rocchini,[255] and Howell & Waddey.[256]

Testing and Control

What may turn out to be one of the most important developments in corrosion testing was a paper by McMaster[257] on the advantages of the *5% salt spray solution modified with acetic acid*, which appears to solve the inherent operating problems of the 20% solution. Another discovery, by Doss,[258] was that a drop of 5% oxalic acid can be used instead of the salt spray test for determining the *quality of black oxide coatings* on steel, being more accurate and reproducible. In other reports, Pinner[259] compared the different *accelerated corrosion tests*, and Hoare[260] offered some observations on assessing the *corrosion behavior of tinplate.*

Very little was reported in the literature on *deposit thickness testing*. Thomas & Rouse[261] described the use of the interference microscope for *decorative chromium* and other thin deposits, and three patents were granted, to Rendel[262] for an apparatus to measure *non-magnetic coatings on magnetic basis materials*, to Robertson for a *method of dissolving tinplate* anodically in HCl solution under an inert atmosphere, followed by titration of the dissolved tin with iodine,[263] and to Garrison & Humphreys[264] on activation of the coatings with beta rays and recording *beta particle emission* to determine thickness.

Some interesting developments were reported on coating quality tests. Wolff, Henderson & Eisler[265] determined the *porosity of nickel deposits* by applying an undercoat of radio-active iron, which affected a photographic film through discontinuities in the deposit, and Heath described a non-destructive test[266] based on *current flow between hot and cold probes.* A non-oxidizing *heat test for plating adhesion*, employing a tin-flowing oil, was suggested by Marcovitch[267] while, from the theoretical standpoint, Pick[268] described a new *method of analyzing stresses and strains* in deposits.

Solution analysis in the plating room will have to continue along previous lines for a while, the literature disclosing only a few articles. Gabrielson determined *alkali metals* in phosphating and cyanide plating solutions by means of *anion exchangers*,[269] while Whitehead & Wright[270] presented a new method for analyzing *acetate in acid zinc baths.* Howard pointed out the *advantages of the spectrograph* for determining impurities in plating solutions,[271] in one case bringing down rejects due to poor adhesion to 0.1 per cent. *Polarography* as applied to the analysis of plating solutions was reviewed by Diaz,[272] while *specific procedures*, employing this instrument were suggested by Downey[273] for *cadmium and zinc* in cyanide solutions, by Versagi[274] for *cadmium*, and by Petrocelli & Tatoian[275] for *copper* in cyanide baths.

Hogaboom[276] suggested a simple test for the presence of *precipitating material in cleaners and acid dips*, one common cause of spotting out. Harris, Stericker & Spring[277] presented an outline of *cleaning tests* to guide those planning work in the evaluation of cleaners or cleaning materials; Mohler[278] described the determination of *oil in vapor degreasers;* Pollack received a patent[279] on a series of loops with varying diameters for testing *surface tension*, and a *slot-type plating range cell* was also described by Mohler.[284]

Although waste treatment was heavily represented in the trade and patent literature, analytical developments were meager. Fisher & Kunin[280] determined *iron in pickle liquors* by titrating the acid before and after removal of the iron by ion exchange, while Serfass, Muraca & Garner studied analysis of traces of *copper in effluents*,[281] *free chlorine*[282] and *lead*.[283]

Waste Treatment

Since *acid pickling wastes* involve the largest volumetric disposal or treatment problem, it is not surprising that they were considered by the largest number of researchers. Reents & Kahler[285] oxidized iron in *hydrochlorc acid pickles* with air and then removed it by ion-exchange. The process is not considered commercially practicable yet. *Sulfuric acid pickling*, which is predominant in industry, was favored by all the other investgators, and ion-exchange methods appeared to be the most popular. Bramer & Coull[286] reported on the results of their research into *electrolytic regeneration*, using a *selectively ion-permeable membrane* to separate recovered acid from the iron, while Horner, Winger, Bodamar & Kunin[287] considered the *econmics and technology* of this treatment method. Another method of removing iron by cation exchange was described by Fradkin & Tooper.[288]

Pickling processes with *continuous regeneration* were described in four patents. Francis & Lynch cooled the

spent acid to below 20° F. in order to crystallize out the iron salts.[289] Irvine [290] disclosed a line consisting of a pickling tank, acid dilution tank and rinse tank in *continuous counterflow*. The spent acid is evaporated, precipitated ferrous sulfate filtered out and concentrated acid and water returned to the dilution and rinse tanks respectively. Miller claimed a process of *pickling in ammonium bisulfate*, removing the dissolved iron by oxidation and precipitation and regeneration of the ammonium bisulfate.[291] He also was granted a patent on an *acid sulfate process* in which the iron is oxidized and the pH raised with ammonia to precipitate iron oxide,[292] after which the ammonium sulfate is recovered and converted back to acid sulfate.

On the subject of operation, Heise & Johnson[293] found that the *best filtration rates* were obtained for lime-neutralized sulfuric acid pickles when 2-5% of the iron is oxidized, a figure much lower than any previously suggested. The methods and equipment for *solids-liquid separation* were discussed by Ledford,[294] while a tank and equipment for controlling *sludge settling* was patented by Viggers.[295] General review articles included a report on some of the *causes for pollution* and suggested cures, by Mulcahy,[296] a review of academic and practical *research on wastes*, by Foulke & Ledford,[297] and a survey of methods and instruments for controlling *rate of flow and pH* of effluents, by Linford.[298]

In the plating room, ion-exchange remained the most commonly employed method, especially since the water and sometimes even the removed chemicals can be returned to process. Many of the articles were *descriptions of commercial installations*, not one research report on any new developments coming to light. Examples of the former types of articles were contributed by Fadgen,[299] by Patton,[300] and by Weisberg & Quinlan.[301] Other general articles included a description of *practical methods* for waste treatment, by Hesler,[302] proper use of ion-exchange processes by Bueltman,[303] a similar one by Tooper,[304] marred by advertising, *rinse water reuse* by ion-exchange, by Bueltman & Mindler,[305] and an evaluation of ion-exchange for *chromium removal*, by Ledford & Hesler.[306] Chemical processes included an article by Dodge & Zabban on the treatment of *cyanide wastes* with hypochlorites,[307] and a patent granted to Lancy[308] on the *in-line treatment* of wastes.

Miscellaneous

Plating machines and apparatus occupied the attention of numerous authors and inventors. Hall[309] described the plating of *tubular furniture* in one of the largest machines built for the purpose. The *economics* of semiautomatic vs. full automatic plating were compared by Brune;[310] Allen reviewed *layout, installation, and maintenance* of plating equipment;[311] and Silman[312] covered the *principles of automation* in this connection. Full automatic *plating machines* were patented by Hauck & Todd,[313] Davis & Clark,[314] Joy,[315] Davis,[316] and Lyon,[317] the last claiming a conveyor for *cylindrical articles*.

Other patents consisted of a *strip plating machine*, claimed by Burgemeister & Healy,[318] a *cathode contact* for continuous wire plating, issued to Holmes & Burns,[319] apparatus for plating the *inside of tubular articles* to Licharz,[320] and for *crankshaft journals* to Wells & Gill.[321] Spot plating or *selective plating* was the subject of two patents, one to Vrilakas[322] and the other to Swanson.[323] A novel *basket plating* apparatus with a vibrator was disclosed by Koury,[324] Cohn[325] claimed one on a method for *plating slides fasteners*, and racks were covered in a patent to Klein[326] and in an article by Preston,[327] who detailed *rack design*, insulation, and applications.

It was gratifying to this reviewer to note the interest in filtration during 1955. Brooks[328] explained how to get the most out of *centrifugal pumps*, and the construction, operation, and application of *different types of filters* were reviewed by Mohler,[329] and by Mohler & Crowley.[330] Ledford & Gilbert[331] described the construction of *equipment for chromium plating solutions*, which introduce special problems, and Merrill[332] discussed the selection of *fabrics for various solutions* and operating conditions. One patent was issued, to Kalinske[333] for a *method of cleaning filters* precoated with diatomite.

Corrosion resistant materials of construction, specifically *rubber and plastics*, were suggested by Mulcahy[334,335] and by Silman,[336] while the single patent was claimed by Seymour & Steiner[337] for an *acid brick floor* construction.

Instrumentation and automatic controls concerned a number of authors. Kushner discussed automatic *plating tank control*;[338] Mohler[339] described the use of *electrical conductivity* to measure concentration for rinse tank control; Taylor[340] covered temperature *control systems;* Holland, Stevens & Arterburn[341] detailed a *solution level control device;* and Fletcher[366] reviewed instrumentation for *process and quality control* in electroplating. Patents were granted to Solecki[342] and to Hakes.[343]

Physical metallurgy was the subject of some highly scientific but very informative papers. Weil & Read[344] examined the *structure of deposits of nickel, cobalt, and copper*, with the electron microscope producing some outstanding photomicrographs. Westman & Mohrnheim reveiwed the literature on the *influence of physical metallurgy* and mechanical processing of the basis metal on plating.[345] Hammond reviewed the *properties and engineering applications* of electrodeposits,[346] and an investigation of the *structure and growth of deposits*, with the effect of brighteners was reported on by Wilman,[347] who concluded that brightening results when the crystals, whether or not of microscopic size, form surfaces which are large and smooth relative to the wavelength of light.

A number of miscellaneous items which fit none of the previous categories were worthy of note. Mohler[348] discussed *plating for shelf life*, Brane[349] detailed *maintenance operations* in a plating department, Hall[350] reviewed the *technical developments* of 1954, and Pierdon tabulated *job shop costs* and their relationship to pricing.[351] *Rinsing techniques* and factors to be considered for improvement were explained by Kushner.[352] *Ultrasonics* were claimed to permit high speed and to eliminate anode polarization by Rich[353] but no data were offered in substantiation. Two unusual processes were patented by Rockafellow,[354] calling for the use of *condenser discharge current* for plating.

Other developments included *nomographs* for determining *surface area* of steel, brass, and aluminum stampings, prepared by Critchfield;[355] the production of good *black deposits on copper* and its alloys by

anodizing in hot NaOH solutions was investigated by Clarke & Andrew[356] to determine the optimum operating conditions; and two patents on *strippers*, one to Meyer[357] on a sodium cyanide solution containing a nitro-aromatic compound, the other to Goral & Goral[358] for an *anodic stripper* consisting of phosphoric, sulfuric, and chromic acids.

Experimental *cadmium plating of screw threads* by Wallbank[359] showed that scatter of thickness on individual items in a barrel load depend more on average thickness of deposit than on any other single factor. DeLong described the process of *plating on magnesium*,[360] stressing the importance of the zinc preplate, and Beach, Schickner & Faust[361] detailed a successful method of producing adherent *deposits on zirconium*, employing a prior etch in a solution of hydrofluoric acid and ammonium fluoride. Quinn[362] discussed the advantages and disadvantages of various deposits for use as *electrical contacts*. To conclude this review, mention should be made of three articles on the problem of *plating porous surfaces*. Mohler[363] suggested the corrective steps to be taken for process and appearance troubles, Cohn[364] discussed some of the factors which hinder successful plating of *metal powder compacts*, and Raymond, Foley & Chu[365] plated these compacts by first *impregnating the surface* with an oil.

BIBLIOGRAPHY

1. J. W. Hensley & R. D. Ring. Plating, **42**, 1137.
2. T. J. Bulat. Metal Prog., **68**, 94 (Dec.).
3. H. B. Linford & P. E. Grubb. Plating, **42**, 895.
4. L. Osipow, H. Pine, C. T. Snell & F. D. Snell. I. E. Chem., **47**, 845.
5. F. W. Hightower. Metal Prog., **68**, 99 (July).
6. J. B. Mohler. Iron Age, **176**, 59 (July 28).
7. Metal Prog., **68**, 169 (Aug. 15).
8. E. R. Holman. U. S. Pat. 2,700,654 (Jan. 25).
9. T. J. Kearney & A. S. McPhee. U. S. Pat. 2,698,627 (Jan. 4).
10. T. J. Kearney. U. S. Pat. 2,721,564 (Oct. 25).
11. W. E. Brucker. U. S. Pat. 2,721,566 (Oct. 25).
12. M. Morris. Metal Fin., **53**, 63 (Feb.).
13. T. J. Kearney. U. S. Pat. 2,700,645 (Jan. 25).
14. C. G. Lueck. U. S. Pat. 2,720,210 (Oct. 11).
15. T. F. McAllister. U. S. Pat. 2,722,593 (Nov. 1).
16. W. Ehlert, G. Kauffman & G. Burrett. Plating, **42**, 1522.
17. W. M. Myers. U. S. Pat. 2,717,476 (Sept. 13).
18. W. S. Kirkland. U. S. Pat. 2,724,928 (Nov. 29).
19. R. W. Moore. U. S. Pat. 2,716,310 (Aug. 30).
20. R. W. Moore. U. S. Pat. 2,724,929 (Nov. 29).
21. W. M. Oddie. U. S. Pat. 2,724,930 (Nov. 29).
22. D. L. Crowe. U. S. Pat. 2,725,684 (Dec. 6).
23. H. Hastrup & D. F. Pinkerton. U. S. Pat. 2,723,498 (Nov. 15).
24. K. F. Hager & M. Rosenthal. U. S. Pat. 2,708,184 (May 10).
25. J. W. Carroll. Metal Fin., **53**, 60 (Mar.).
26. D. Jackson, A. J. Stedman & R. V. Riley. Met. Fin. J., (Br.), **1**, 435.
27. D. J. Fishlock. Prod. Fin. (Br.), **8**, 61 (Nov.).
28. A. G. Gardner. Met. Fin. J. (Br.), **1**, 117.
29. W. A. Risher. Iron Age, **175**, 95 (May 12).
30. F. F. Jaray. Metal Fin., **53**, 68 (Mar.).
31. R. E. Carter. U. S. Pat. 2,717,845 (Sept. 13).
32. J. Starr. Metal Fin., **53**, 65 (Feb.).
33. W. J. Barth & A. L. Feild, Jr. Metal Prog., **68**, 114 (Aug. 1).
34. C. D. MacPherson. U. S. Pat. 2,724,667 (Nov. 22).
35. S. J. Morana. Plating, **42**, 1144.
36. E. B. Fernsler & H. E. Tschop. U. S. Pat. 2,710,271 (June 7).
37. L. McDonald & A. E. Hawley. U. S. Pat. 2,710,792 (June 14).
38. A. E. Westman & F. A. Mohrnheim. Plating, **42**, 281, 417.
39. J. Badaluco. Plating, **42**, 739.
40. J. H. Keating. Finish, **12**, 33 (July).
41. E. L. Lotz. U. S. Pat. 2,698,504 (Jan. 4).
42. A. Field. U. S. Pat. 2,700,852 (Feb. 1).
43. G. A. Lyon. U. S. Pat. 2,699,632 (Jan. 18).
44. R. O. Peterson. U. S. Pat. 2,794,916 (Mar. 29).
45. J. R. Davies. U. S. Pat. 2,711,619 (June 28).
46. C. R. Upham. U. S. Pat. 2,716,314 (Aug. 30).
47. J. Myer. U. S. Pat. 2,718,737 (Sept. 27).
48. G. R. Churchill. U. S. Pat. 2,724,937 (Nov. 29).
49. R. O. Peterson. U. S. Pat. 2,794,854 (Mar. 29).
50. R. O. Peterson. U. S. Pat. 2,714,738 (Aug. 9).
51. R. O. Peterson. U. S. Pat. 2,703,472 (Mar. 8).
52. N. E. Nielson. U. S. Pat. 2,705,855 (Apr. 12).
53. M. E. Landau. U. S. Pat. 2,700,257 (Jan. 25).
54. R. J. Swan. U. S. Pat. 2,709,323 (May 31).
55. R. J. Swan. U. S. Pat. 2,713,759 (July 26).
56. M. C. Klug. U. S. Pat. 2,720,064 (Oct. 11).
57. W. H. Storrs & A. J. Wells. U. S. Pat. 2,712,987 (July 12)
58. E. R. Lindenborg. U. S. Pat. 2,714,790 (Aug. 9).
59. H. S. Orr. U. S. Pat. 2,714,787 (Sept. 9).
60. E. L. Anderson. U. S. Pat. 2,720,061 (Oct. 11).
61. G. A. Carlson. U. S. Pat. 2,722,786 (Nov. 8).
62. O. Thiel. U. S. Pat. 2,722,788 (Nov. 8).
63. F. G. Krafft. U. S. Pat. 2,723,505 (Nov. 15).
64. J. Smedley. U. S. Pat. 2,726,491 (Dec. 13).
65. G. G. Sherrill & D. W. Massey. U. S. Pat. 2,699,016 (Jan. 11).
66. E. Dackor & E. F. Nelboeck. U. S. Pat. 2,699,019 (Jan. 11).
67. C. C. Kinker & J. J. Murtagh. U. S. Pat. 2,700,254 (Jan. 25).
68. E. E. Murray. U. S. Pat. 2,701,937 (Feb. 15).
69. C. C. Kinker. U. S. Pat. 2,718,736 (Sept. 27).
70. E. K. Brown. U. S. Pat. 2,719,391 (Oct. 4).
71. O. Thiel. U. S. Pat. 2,722,784 (Nov. 8).
72. K. F. Lorking. Metal Fin., **53**, 64 (May).
73. K. F. Lorking. Bull. Inst. Met. Fin., **5**, 119.
74. K. F. Lorking. J. Electrochem. Soc., **102**, 479.
75. A. T. Steer. Electropl., **8**, 245.
76. R. Mondon. Sheet Met. Ind., **32**, 923.
77. A. W. Brace. Metal Fin. J. (Br.), **1**, 253, 278.
78. H. L. Turner. U. S. Pat. 2,708,655 (May 17).
79. M. Reichert. U. S. Pat. 2,712,524 (July 5).
80. J. Fischer. U. S. Pat. 2,712,525 (July 5).
81. H. R. Strobel. U. S. Pat. 2,725,353 (Nov. 29).
82. A. N. Gray. U. S. Pat. 2,725,355 (Nov. 29).
83. G. E. Murray. U. S. Pat. 2,725,354 (Nov. 29).
84. H. R. Strobel. U. S. Pat. 2,725,352 (Nov. 29).
85. A. Hickling & A. J. Rostron, Trans. Inst. Met. Fin., **32**, No. 7.
86. J. G. Beach. U. S. Pat. 2,711,364 (June 21).
87. R. Pinner. Electropl., **8**, 4.
88. J. F. Jumer. U. S. Pat. 2,705,191 (Mar. 29).
89. J. F. Murphy. U. S. Pat. 2,719,079 (Sept. 27).
90. F. H. Hesch. U. S. Pat. 2,719,781 (Oct. 4).
91. F. Feldmann. Prod. Fin. (Br.), **8**, 78 (May).
92. L. Mable. Bull. Inst. Met. Fin., **4**, 289.
93. C. J. Kellard. Electropl., **8**, 95, 149.
94. S. Arensten. Met. Fin. J. (Br.), **1**, 199.
95. J. H. Bryan. Met. Fin. J. (Br.), **1**, 123.
96. C. B. Vincent. U. S. Pat. 2,721,426 (Oct. 25).
97. G. W. Bell. U. S. Pat. 2,703,550 (Mar. 8).
98. R. C. Spooner. J. Electrochem. Soc., **102**, 157.
99. R. B. Mason. J. Electrochem. Soc., **102**, 671.
100. A. W. Brace. Metal Ind., **87**, 261.
101. S. Wernick & R. Pinner. Metal Fin., **53**, 91 (June).
102. S. Wernick & R. Pinner. Metal Fin., **53**, 69 (Sept.); 52 (Oct.); 74 (Nov.).
103. S. Wernick & R. Pinner. Sheet Met. Ind., **32**, 345.
104. C. C. Cohn. Iron Age, **175**, 91 (May 26); 95 (June 2).
105. W. McNeill. Metal Fin., **53**, 61 (Feb.).
106. C. Etienne. Electropl., **8**, 359.
107. J. Backer. U. S. Pat. 2,721,837 (Oct. 25).
108. F. H. Hesch. U. S. Pat. 2,703,781 (Mar. 8).
109. W. G. Axtell. U. S. Pat. 2,721,835 (Oct. 25).
110. S. Wernick & R. Pinner. Sheet Met. Ind., **32**, 35, 113, 189, 273.
111. R. F. Hafer. Metal Prog., **67**, 93 (May).
112. M. L. Ihrie & F. A. Root. U. S. Pat. 2,709,847 (June 7).
113. R. J. Heritage. Bull. Inst. Met. Fin., **5**, 106.

114. F. J. Hansgirg. U. S. Pat. 2,709,154 (May 24).
115. M. L. Hughes & D. F. Thomas. Metallurgia, **52**, 241.
116. B. S. Westerman. Prod. Fin., **19**, 62 (Sept.).
117. M. L. Hughes. Met. Fin. J. (Br.), **1**, 447.
118. M. G. Whitfield. U. S. Pat. 2,702,525 (Feb. 22).
119. H. Lundin. U. S. Pat. 2,708,304 (May 17).
120. T. H. Westby. U. S. Pat. 2,706,161 (Apr. 12).
121. H. P. Legg. U. S. Pat. 2,698,811 (Jan. 4).
122. O. Kardos, T. J. Menzel & J. L. Sweet. U. S. Pat. 2,712,522 (July 5).
123. T. E. Such. Electropl., **8**, 308, 347.
124. T. E. Such. Bull. Inst. Met. Fin., **5**, No. 1, 45.
125. C. B. Young & W. Strobach. Metal Fin., **53**, 44 (July); 53 (Aug.); 79 (Sept.).
126. F. G. Brune & V. L. McEnally, Jr. Plating, **42**, 1127.
127. M. Weinberg & A. Lake. Plating, **42**, 144.
128. W. H. Prine. U. S. Pat. 2,726,201 (Dec. 6).
129. R. W. Moeller & W. A. Snell. Plating, **42**, 1537.
130. J. W. Oswald. Electropl., **8**, 379.
131. J. B. Mohler. Iron Age, **175**, 100 (Mar. 10).
132. J. L. Chinn. Mater. & Meth., **41**, 104 (May).
133. P. Talmey & W. J. Crehan. U. S. Pat. 2,717,218 (Sept. 6).
134. H. J. Jendrzynski & T. F. Stapleton. U. S. Pat. 2,721,814 (Oct. 25).
135. R. A. Spaulding. U. S. Pat. 2,726,968-9 (Dec. 13).
136. R. Pearlstein. Metal Fin., **53**, 59 (Aug.).
137. P. H. Eisenberg & H. C. Schneider. Plating, **42**, 1268.
138. R. H. Rousselot. Metal Fin., **53**, 50 (May); 99 (June).
139. G. Gabrielson. Metal Fin., **53**, 56 (May).
140. H. Fry. Trans. Inst. Met. Fin., **32**, No. 2.
141. C. Williams & R. A. Hammond. Trans. Inst. Met. Fin., **32**, No. 1.
142. J. E. Stareck, E. J. Seyb & A. C. Tulumello. Plating, **42**, 1395.
143. H. Silman. Trans. Inst. Met. Fin., **5**, No. 11, 33.
144. H. Silman. Met. Fin. J. (Br.), **1**, 11.
145. H. J. West. Metal Fin., **53**, 62 (July).
146. T. Yoshida. U. S. Pat. 2,704,273 (Mar. 15).
147. J. P. Scanlon. U. S. Pat. 2,719,095 (Sept. 27).
148. W. P. Karash. U. S. Pat. 2,714,088 (July 26).
149. P. Eyerund. U. S. Pat. 2,702,785 (Feb. 22).
150. E. J. Wilhelm & R. F. Kayser. Plating, **42**, 406.
151. H. Sadek, M. Halfawy & S. G. Abdu. J. Electrochem. Soc., **102**, 226.
152. R. P. Nevers. Electrotypers & Stereotypers Mag., **41**, 93 (June).
153. W. H. Safranek & C. L. Faust. Plating, **42**, 1541.
154. M. S. Kantrowitz & A. E. Yelmgren. U. S. Pat. 2,703,295 (Mar. 1).
155. M. Meth. U. S. Pat. 2,720,487 (Oct. 11).
156. C. J. Wernlund. U. S. Pat. 2,701,234 (Feb. 1).
157. G. W. Jernstedt & M. Ceresa. U. S. Pat. 2,700,019 (Jan. 18).
158. W. J. Pierce. U. S. Pat. 2,700,020 (Jan. 18).
159. H. Brown & R. A. Fellows. U. S. Pat. 2,707,166 (Apr. 26).
160. E. W. Hoover. U. S. Pat. 2,707,167 (Apr. 26).
161. W. H. Millward. Plating, **42**, 545.
162. R. H. Wolff. Metal Fin., **53**, 48 (Apr.).
163. R. E. Alexander. U. S. Pat. 2,703,311 (Mar. 1).
164. R. Pottberg & E. T. Clayton. U. S. Pat. 2,723,204 (Nov. 8).
165. C. A. Discher. J. Electrochem. Soc., **102**, 617.
166. C. A. Discher & F. C. Mathers. J. Electrochem. Soc., **102**, 387.
167. J. B. Mohler. Metal Fin., **53**, 59 (Apr.).
168. A. E. Carlson. Plating, **42**, 1149.
169. Anon. Metal Fin., **53**, 66 (Nov.).
170. F. Bauch. U. S. Pat. 2,721,119 (Oct. 18).
171. P. J. Sloane & I. Cross. Iron Age, **176**, 120 (Nov. 17).
172. E. A. Parker. Plating, **42**, 882.
173. L. A. Suchoff. U. S. Pat. 2,702,252 (Mar. 1).
174. J. Toth & H. E. Ricks. Metal Fin., **53**, 44 (Oct.).
175. H. S. Lukens. U. S. Pat. 2,705,830 (Apr. 12).
176. H. C. Gatos & F. C. Mathers. J. Electrochem. Soc., **102**, 554.
177. M. E. Sibert & M. A. Steinberg. J. Electrochem. Soc., **102**, 641.
178. W. P. Karash. U. S. Pat. 2,711,010 (June 21).
179. D. G. Burnside. U. S. Pat. 2,715,096 (Aug. 9).
180. A. H. DuRose. U. S. Pat. 2,721,836 (Oct. 25).
181. W. R. Meyer. U. S. Pat. 2,714,089 (July 26).
182. R. E. Harr. U. S. Pat. 2,710,832 (June 14).
183. R. S. Dean. U. S. Pat. 2,717,870 (Sept. 13).
184. S. Senderoff & A. Brenner. U. S. Pat. 2,715,093 (Aug. 9).
185. E. Wainer. U. S. Pat. 2,707,170 (Apr. 26).
186. F. E. Kendall & J. R. Kusa. U. S. Pat. 2,726,175 (Dec. 6).
187. F. A. Lowenheim & R. T. Gore. Iron Age, **176**, 67 (Dec. 22).
188. D. W. Ernst, R. F. Amlie & M. L. Holt. J. Electrochem. Soc., **102**, 461.
189. T. P. Hoar & I. A. Bucklow. Trans. Inst. Met. Fin., **32**, No. 5.
190. S. Jepson, S. Meecham & F. W. Salt. Trans. Inst. Met. Fin., **32**, No. 4.
191. E. J. Roehl, E. Michel & L. R. Westbrook. Plating, **42**, 403.
192. F. Feldmann. Prod. Fin. (Br.), **8**, 56 (Feb.).
193. F. A. Lowenheim. Metal Fin., **53**, 51 (July).
194. J. B. Mohler. Metal Fin., **53**, 47 (Oct.).
195. E. Heymann & G. Schmerling. U. S. Pat. 2,722,508 (Nov. 1).
196. A. E. Chester. U. S. Pat. 2,700,646 (Jan. 25).
197. N. W. Hovey, J. L. Griffin & A. Krohn. J. Electrochem. Soc., **102**, 470.
198. R. T. Putnam & E. J. Roser. Plating, **42**, 1133.
199. C. L. Faust. U. S. Pat. 2,718,494 (Sept. 20).
200. J. G. Beach. U. S. Pat. 2,727,856 (Dec. 20).
201. R. T. Gore. Mater. & Meth., **42**, 102 (Oct.).
202. S. C. Britton & R. W. Stacpoole. Trans. Inst. Met. Fin., **32**, No. 6.
203. S. C. Britton & R. W. Stacpoole. Metallurgia, **52**, 64 (Aug.).
204. V. Spreter & J. Mermillod. U. S. Pat. 2,724,687 (Nov. 22).
205. C. Campana. U. S. Pat. 2,719,821 (Oct. 4).
206. S. Wein. Prod. Fin., **19**, 24 (Feb.).
207. J. Keating. Metal Fin., **53**, 76 (Sept.).
208. E. A. Bergstrom. U. S. Pat. 2,702,253 (Feb. 15).
209. R. M. Barnard & S. E. Buckley. U. S. Pat. 2,706,682 (Apr. 19).
210. C. Bosch. U. S. Pat. 2,717,840 (Sept. 13).
211. H. D. Rice. Mater. & Meth., **42**, 99 (Sept.).
212. P. M. Walker, N. E. Bentley & L. E. Hall. Trans. Inst. Met. Fin., **32**, No. 11.
213. V. J. Marchese. U. S. Pat. 2,706,170 (Apr. 12).
214. S. V. Lindbom. U. S. Pat. 2,699,423 (Jan. 11).
215. T. Nieter. U. S. Pat. 2,699,424-5 (Jan. 11).
216. D. J. Donahue & A. M. Rennie. U. S. Pat. 2,702,270 (Feb. 15).
217. F. C. Weil. Bull. Inst. Met. Fin., **5**, 169.
218. P. J. Clough & P. Godley, 2nd. U. S. Pat. 2,703,334 (Mar. 1).
219. M. Auwarter. U. S. Pat. 2,719,097 (Sept. 27).
220. P. Pawlyk. U. S. Pat. 2,700,365 (Jan. 25).
221. J. W. Schell. U. S. Pat. 2,704,992 (Mar. 29).
222. P. Pawlyk. U. S. Pat. 2,701,901 (Feb. 15).
223. H. Schladitz. U. S. Pat. 2,698,812 (Jan. 4).
224. P. Pawlyk. U. S. Pat. 2,704,727 (Mar. 22).
225. P. Pawlyk. U. S. Pat. 2,704,728 (Mar. 22).
226. W. W. Castor. U. S. Pat. 2,710,817 (June 14).
227. R. A. Stauffer. U. S. Pat. 2,698,810 (Jan. 4).
228. E. Wainer & R. A. Kempe. U. S. Pat. 2,711,973 (June 28),
229. W. R. Cavanagh & R. C. Gibson. Plating, **42**, 742.
230. W. E. Pocock. Metal Fin., **53**, 80 (Jan.).
231. M. Hardouin. Metal Ind., **87**, 385, 408.
232. S. Wernick & R. Pinner. Metal Fin., **53**, 66 (Feb.); 73 (Mar.).
233. W. McNeill. Metal Fin., **53**, 57 (Dec.).
234. F. Ogburn, H. I. Salmon & M. L. Kronenberg. Plating, **42**, 271.
235. L. O. Gilbert, S. L. Eisler, J. Doss & W. D. McHenry. Metal Fin., **53**, 56 (Apr.).
236. A. E. Chester. U. S. Pat. 2,727,841 (Dec. 20).
237. L. L. Deer. U. S. Pat. 2,705,500 (Apr. 5).
238. M. Hyams & A. Nicholson. U. S. Pat. 2,702,768 (Feb. 22).
239. D. E. Miller. U. S. Pat. 2,715,059 (Aug. 9).
240. W. S. Russell. U. S. Pat. 2,724,668 (Nov. 22).
241. H. A. Evangelides. U. S. Pat. 2,723,952 (Nov. 15).
242. J. E. Baxter. U. S. Pat. 2,715,083 (Aug. 9).
243. A. Renold. U. S. Pat. 2,701,238 (Feb. 1).
244. H. B. Marshall & W. R. Bennett. U. S. Pat. 2,709,653 (May 31).
245. A. Wachter & T. Skei. U. S. Pat. 2,711,360 (June 21).

246. A. Wachter & R. J. Moore. U. S. Pat. 2,717,196 (Sept. 6).
247. A. Wachter & N. Stillman. U. S. Pat. 2,717,843 (Sept. 13).
248. H. E. Fales. U. S. Pat. 2,701,206 (Feb. 1).
249. E. F. Fields. U. S. Pat. 2,703,784 (Mar 8).
250. J. M. Michel & K. F. Hager. U. S. Pat. 2,704,264 (Mar. 15).
251. W. B. Hughes & R. E. Lembcke. U. S. Pat. 2,706,714 (Apr. 19).
252. S. E. Jolly. U. S. Pat. 2,708,660 (May 17).
253. C. E. Paxton. U. S. Pat. 2,716,611 (Aug. 30).
254. H. W. Rudel & M. Gargisa. U. S. Pat. 2,718,500 (Sept. 20).
255. A. G. Rocchini. U. S. Pat. 2,718,503 (Sept. 30).
256. W. C. Howell, Jr. & W. E. Waddey. U. S. Pat. 2,724,654 (Nov. 22).
257. W. D. McMaster. A. S. T M. Bull., **#203**, 62 (Jan.).
258. J. Doss. Metal Fin., **53**, 48 (Dec.).
259. W. L. Pinner. Plating, **42**, 1039.
260. W. E. Hoare. Sheet Met. Ind., **32**, 176.
261. J. D. Thomas & S. R. Rouse. Plating, **42**, 55.
262. G. H. Rendel. U. S. Pat. 2,703,384 (Mar. 1).
263. D. P. Robertson. U. S. Pat. 2,716,596 (Aug. 30).
264. J. W. Garrison & R. F. Humphreys. U. S. Pat. 2,723,351 (Nov. 8).
265. R. H. Wolff, M. A. Henderson & S. L. Eisler. Plating, **42**, 537.
266. A. R. Heath. Met. Fin. J. (Br.), **1**, 145.
267. I. W. Marcovitch. Plating, **42**, 749.
268. H. J. Pick. Trans. Inst. Met. Fin., **32**, No. 3.
269. G. Gabrielson. Metal Fin., **53**, 58 (Feb.).
270. T. H. Whitehead & H. W. Wright. Anal. Chem., **27**, 1834.
271. A. M. Howard. Iron Age, **176**, 98 (July 7).
272. R. Diaz. Plating, **42**, 415.
273. T. A. Downey. Plating, **42**, 267.
274. F. J. Versagi. Finish, **12**, 29 (Aug.).
275. J. V. Petrocelli & G. Tatoian. Plating, **42**, 550.
276. G. B. Hogaboom, Jr. Metal Fin., **53**, 54 (May).
277. J. C. Harris, W. Stericker & S. Spring. A. S. T. M. Bull., **#204**, 31 (Feb.).
278. J. B. Mohler. Metal Fin., **53**, 66 (May).
279. M. Pollack. U. S. Pat. 2,710,539 (June 14).
280. S. Fisher & R. Kunin. Anal. Chem., **27**, 1649.
281. E. J. Serfass, R. F. Muraca & D. G. Gardner. Plating, **42**, 64.
282. E. J. Serfass, R. F. Muraca & D. G. Gardner, Plating, **42**, 401.
283. E. J. Serfass & R. M. Muraca. Plating, **42**, 751.
284. J. B. Mohler. Metal Fin., **53**, 53 (July).
285. A. C. Reents & F. H. Kahler. I. E. Chem., **47**, 75.
286. H. C. Bramer & J. Coull. I. E. Chem., **47**, 67.
287. C. Horner, A. G. Winger, G. W. Bodamer & R. Kunin. I. E. Chem., **47**, 1121.
288. A. M. Fradkin & E. B. Tooper. I. E. Chem., **47**, 87.
289. C. B. Francis & E. Lynch. U. S. Pat. 2,709,143 (May 24).
290. R. L. Irvine. U. S. Pat. 2,721,562 (Oct. 25).
291. C. O. Miller. U. S. Pat. 2,700,004 (Jan. 18).
292. C. O. Miller. U. S. Pat. 2,720,472 (Oct. 11).
293. L. W. Heise & M. Johnson. Sewage & Ind. Wastes, **27**, 190.
294. R. F. Ledford. Plating, **42**, 1030.
295. C. G. Viggers. U. S. Pat. 2,717,697 (Sept. 13).
296. E. W. Mulcahy. Met. Fin. J. (Br.), **1**, 289.
297. D. G. Foulke & R. F. Ledford. Metal Fin., **53**, 67 (Jan.).
298. A. Linford. Electropl., **8**, 384.
299. T. J. Fadgen. Sewage & Ind. Wastes, **27**, 206.
300. W. G. Patton. Iron Age, **175**, 102 (May 5).
301. L. Weisberg & E. J. Quinlan. Plating, **42**, 1006.
302. J. C. Hesler. Plating, **42**, 1019.
303. C. Bueltman. Metal Fin., **53**, 40 (Apr.).
304. E. B. Tooper. Plating, **42**, 1416.
305. C. Bueltman & A. B. Mindler. Plating, **42**, 1912.
306. R. F. Ledford & J. C. Hesler. I. E. Chem., **47**, 83.
307. B. F. Dodge & W. Zabben. Plating, **42**, 71.
308. L. E. Lancy. U. S. Pat. 2,725,314 (Nov. 29).
309. N. Hall. Metal Fin., **53**, 45 (Aug.).
310. F. G. Brune. Prod. Fin., **20**, 44 (Oct.).
311. R. Allen. Metal Ind., **86**, 67, 107, 147.
312. H. Silman. Electropl., **8**, 91, 136, 184.
313. P. A. Hauck & G. Todd. U. S. Pat. 2,710,698 (June 14).
314. J. V. Davis & C. G. Clark. U. S. Pat. 2,716,415 (Aug. 30).
315. C. L. Joy. U. S. Pat. 2,716,989 (Sept. 6).
316. J. V. Davis. U. S. Pat. Reissue 24,072 (Oct. 11).
317. G. A. Lyon. U. S. Pat. 2,711, 993 (June 28).
318. P. A. Burgemeister & T. J. Healy. U. S. Pat. 2,729,953 (Nov. 15).
319. A. W. Holmes & R. H. Burns. U. S. Pat. 2,708,181 (May 10).
320. C. E. Licharz. U. S. Pat. 2,706,175 (Apr. 12).
321. H. R. Wells & F. P. Gill. U. S. Pat. 2,706,173-4 (Apr. 12).
322. M. Vrilakas. U. S. Pat. 2,710,834 (June 14).
323. H. S. Swanson. U. S. Pat. 2,698,832 (Jan. 4).
324. F. Koury. U. S. Pat. 2,721,834 (Oct. 25).
325. C. C. Cohn. U. S. Pat. 2,715,095 (Aug. 9).
326. F. J. Klein. U. S. Pat. 2,727,858 (Dec. 20).
327. J. Preston. Metal Ind., **86**, 189.
328. E. Brooks. Metal. Fin., **53**, 57 (Oct.).
329. J. B. Mohler. Metal Fin., **53**, 51 (Dec.).
330. J. B. Mohler & C. E. Crowley. Metal Fin., **53**, 52 (Feb.).
331. R. F. Ledford & L. O. Gilbert. Plating, **42**, 1151.
332. T. B. Merrill, Jr. Mater. & Meth., **42**, 108 (Aug.).
333. A. A. Kalinske. U. S. Pat. 2,710,099 (June 7).
334. E. W. Mulcahy. Bull. Inst. Met. Fin., **5**, 149.
335. E. W. Mulcahy. Met. Fin. J. (Br.), **1**, 151.
336. H. Silman. Prod. Fin. (Br.), **8**, 56 (Apr.), 54 (May).
337. R. B. Seymour & R. H. Steiner. U. S. Pat. 2,718,829 (Sept. 27).
338. J. B. Kushner. Metal Fin., **53**, 59 (May).
339. J. B. Mohler. Metal Fin., **53**, 66 (Sept.)
340. D. W. Taylor. Met. Fin. J. (Br.), **1**, 383.
341. J. W. Holland, L. Stevens & N. Arterburn, Plating, **42**, 1412.
342. J. E. Solecki. U. S. Pat. 2,724,690 (Nov. 22).
343. L. G. Hakes. U. S. Pat. 2,724,691 (Nov. 22).
344. R. Weil & H. J. Read. Metal Fin., **53**, 60 (Nov.), 60 (Dec.).
345. A. E. Westman & F. A. Mohrnheim. Plating, **42**, 154.
346. R. A. Hammond. Met. Fin. J. (Br.), **1**, 193, 259.
347. H. Wilman. Trans. Inst. Met. Fin., **32**, No. 9.
348. J. B. Mohler. Metal Fin., **53**, 64 (Mar.).
349. F. G. Brane. Prod. Fin., **19**, 32 (May).
350. N. Hall. Metal Fin., **53**, 58 (Jan.).
351. A. G. Pierdon. Plating, **42**, 1534.
352. J. B. Kushner. Metal Fin., **53**, 76 (Jan.).
353. S. R. Rich. Plating, **42**, 1407.
354. S. C. Rockafellow. U. S. Pat. 2,726,202-3 (Dec. 6).
355. L. A. Critchfield. Prod. Fin., **20**, 34 (Dec.).
356. S. G. Clarke & J. F. Andrew. Trans. Inst. Met. Fin., **32**, No. 8.
357. W. R. Meyer. U. S. Pat. 2,698,781 (Jan. 4).
358. R. W. Goral & R. Goral. U. S. Pat. 2,706,171 (Apr. 12).
359. A. W. Wallbank. Trans. Inst. Met. Fin., **32**, No. 10.
360. H. K. DeLong. Metal Prog., **67**, 102 (Apr.).
361. J. G. Beach, W. C. Schickner & C. L. Faust. U. S. Pat. 2,711,389 (June 21).
362. P. Quinn. Metallurgia, **52**, 115.
363. J. B. Mohler. Metal Fin., **53**, 70 (Nov.).
364. C. C. Cohn. Metal Ind., **87**, 128.
365. E. V. Raymond, R. T. Foley & W. L. Chu. Plating, **42**, 150.
366. J. L. Fletcher. Metal Ind., **86**, 533.

Practical Throwing Power

By J. B. Mohler, *Consultant, New Castle, Penna.*

THROWING power may be defined as the ability of a plating bath to deposit in recessed areas. Perhaps it would be better to say that plating baths are limited in ability to deposit metal in recessed area, but that some are less limited than others. For this property is really defining a limitation rather than an ability. However some baths are much less limited than others.

Throwing power has been studied extensively and many quantitative measurements have been made to numerically define this property. Such measurements have shown that the throwing power of various baths could be improved by changing the bath composition. On the other hand, no matter what has been done, the limitation has still persisted. It has been very seldom that a production problem has been solved by changing a plating bath formula in order to improve the throwing power. No doubt, there have been a few cases, and there have definitely been cases where the throw was improved by changing the practice prior to plating. These latter effects were really a result of improving the covering power. In theory, throwing power and covering power are two separate properties. Throwing power is a property of the bath, whereas covering power is influenced by the type of metal and the condition of this metal on which the deposit is applied. For practical purposes, covering power and throwing power are definitely related. Any means of solving the production problem of plating in a recessed area is a satisfactory answer. Such problems have been solved by the use of strike baths. Covering of steel from acid tin and lead baths has been improved by the use of a copper strike prior to plating. Also, it has been shown that special processing is required to obtain good coverage of buffed nickel and other surfaces with chromium.[1]

Formulas for Throwing Power

Experimental throwing power figures are of value to classify and compare the plating baths. The best known work is that of Haring and Blum who devised a throwing power box and a formula to express the result.[2] In this method, the ratio of the distance of the anode to a near and a far cathode on either side of the anode is 5 to 1 (Figure 1). The Primary Current Distribution Ratio (L) is defined as 5. The ratio of the weight of deposit on the two cathodes is defined as Metal Distribution Ratio (M). The following formula is used to define throwing power:

$$\frac{L - M}{L} \times 100 = \%\ \text{T.P. (H. \& B.)}$$

A committee of the British Standards Institution has proposed the formula:

$$\frac{L - M}{L + M - 2} \times 100 = \%\ \text{T.P. (B.S.I.)}$$

This formula was chosen so that T.P. = 100% when metal distribution is uniform, 0% when L = M and — 100% when the cathode efficiency is zero on the far cathode.

It is good to take a broad look at throwing power to appreciate the extent to which plating baths are limited by this factor. Figure No. 2 shows the usual throwing power for the common plating baths. A number of facts are immediately apparent.

The chromic acid bath is in a class by itself. The

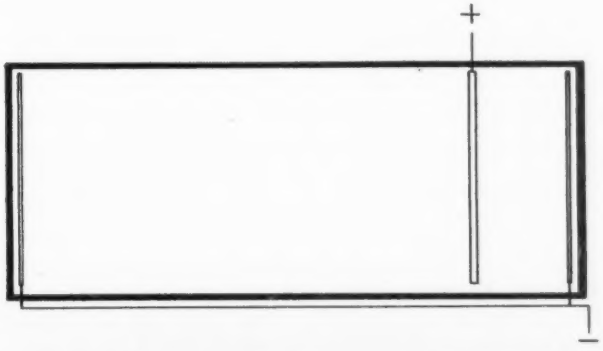


Figure 1. Haring and Blum Throwing Power Box with 5 to 1 Ratio.

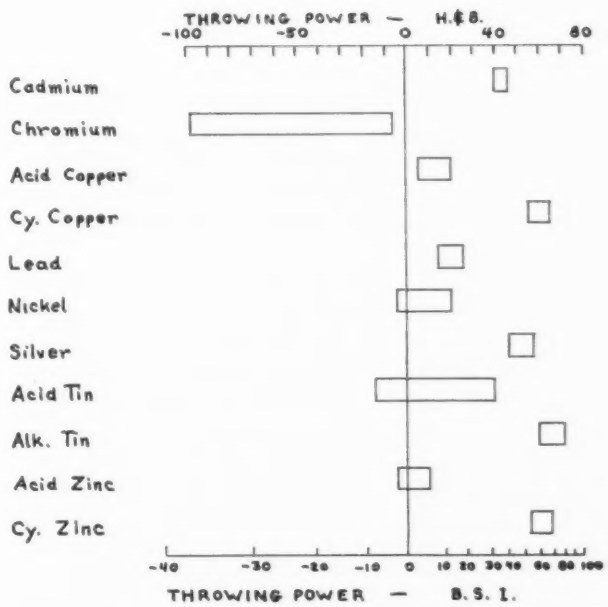


Figure 2. Throwing Power of Common Platirg Baths.

cause for this is that the cathode efficiency decreases with decrease in current density which is definitely unfavorable to deposit metal in low current density areas.

It is readily seen that the acid baths are all low in throwing power as compared to the alkaline-cyanide baths. Metal is deposited more easily from acid baths at high current densities than from the alkaline baths. Since cathode polarization does not have as great an inhibiting effect on the acid baths, the metal distribution is greatly influenced by the differences in anode-cathode distance. Thus, the metal distribution of the acid baths corresponds more closely to the theoretical primary current distribution, or the throwing power is closer to zero than for the alkaline baths.

The throwing power for all of the alkaline baths is better than the acid baths; however, it can be seen that the high efficiency cadmium and silver baths are lower in throwing power than the other lower efficiency alkaline-cyanide baths.

The alkaline tin bath can be used as a practical standard for comparison of throwing power. For this bath a good deposit can be obtained at almost, if not any, current density. At high total currents the cathode efficiency increases markedly as the current density decreases. Thus at high average current densities the metal distribution will approach the ideal. In fact in some cases the metal distribution from such a bath, although not uniform, is ideal. Where wear is a factor, it is an advantage to have more metal deposited on edges and corners exposed to wear than in recessed areas protected from wear. The same type of metal distribution can be obtained from the cyanide baths by plating with low metal concentrations to favor a drop in cathode efficiency with increase in current density. Such practices account for the good covering power of the copper and silver cyanide strike baths. Unfortunately the plating rate is low from such baths.

The high efficiency alkaline and cyanide baths, such as the high metal content potassium baths, have been

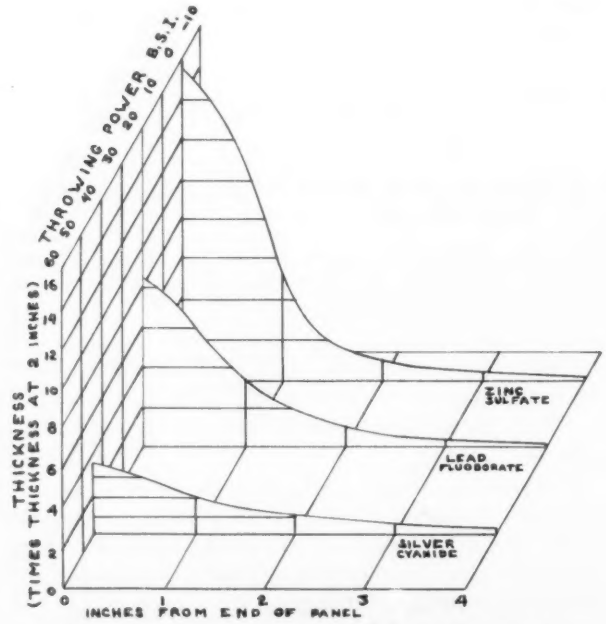


Figure 3. Metal Distribution from Three Plating Baths.

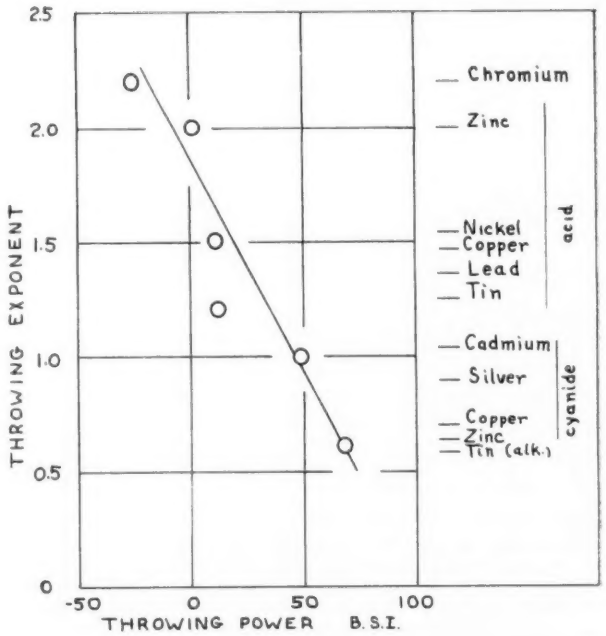


Figure 4. Exponential Effect of Throwing Power.

gaining in popularity for a number of years because of the advantages of higher plating rates. The throwing power of these baths is not as good as for the low efficiency baths, although it is still much better than for the acid baths.

Solving Metal Distribution Problems

Metal distribution problems can often be solved by anode arrangement, robbing or shadowing. Much more can usually be done by changing the geometry of the anode-cathode relationship than by changing the bath. However these methods are not always practical for low-cost, high-production methods. If such is the case, it is best to fully appreciate the limitations of throwing power as a basis to decide if another type of bath offers a possible solution. It may be possible to substitute an undercoating from a high throwing power bath as a possible solution. Thus nickel over copper may be a possible answer where nickel alone is impractical to obtain a sufficient thickness in a recessed area. The same may apply for nickel as an undercoating for chromium.

Perhaps it is helpful to visualize the manner in which the thickness decreases with increasing distance from the anode. Figure 3 shows the metal distribution along a cathode as measured with a slot-type plating range cell.[3] It can be seen that the tendency of the metal to deposit on areas remote from the anode decreases appreciably with decrease in throwing power. A quantitative estimation of this effect was also made from a study of plating on the inside of a cylindrical cathode with an off-center (eccentric) anode.[4] For the metal thickness at the near and far points it was found that this could be expressed as an exponent. For the theoretical case, the current distribution varies as the square of the distance from the anode. If the throwing power is greater than zero, the exponent will be less than 2. This is shown as a graphical approximation in Figure 4. It is to be expected that, at T.P. = 0, the exponent will be 2.0 and that, at T.P. = 100, the exponent will

be zero. The approximate average value for the common plating baths is indicated at the right of Figure 4. The tremendous difference between chromium and alkaline tin is readily apparent. The range from nickel to acid tin is not great and, in fact, for specific baths the values of the four baths in this range could be reversed.

Off-hand it might be expected that throwing power problems could be solved by keeping the anode-cathode distance large. For some cases this is true. For instance, a uniform deposit can easily be obtained on a wire from a single anode. This is because the anode-cathode distance is large with respect to the diameter of the wire. This cannot be applied to a partially enclosed recess as shown in Figure 5. The walls of the recess limit such a case. Plating will be no better at 10 times the anode-cathode distance than at 1½ times the distance where the distance units are in terms of the size of the opening. The exponential effect applies for about one times the distance. For this case, better distribution is obtained by using smaller anodes closer to the opening and the best results are obtained by allowing the anode to project into the opening.

If a throwing power problem cannot be solved by selection of a plating bath then the answer either lies in the geometry of the plating system (anode arrangement, robbing or shadowing) or in redesign of the part.

Geometric problems have been solved by the classical mathematical methods of Kasper.[5] This approach has been used as a guide for practical problems, but the methods are complicated and sufficient data are not available for complete solutions. Kinney and Festa have developed a method for the study of geometric problems by the use of models constructed from conducting paper.[6]

By the use of two dimensional models and an estimation of the effect of throwing power and cathode efficiency it should be possible to design plating racks to obtain practical designs for plating of complicated shapes.

The experimental approach offers the best possibilities for the solution of throwing power problems at the present time. The problem of plating in corners has been a serious limitation to which no answer has been

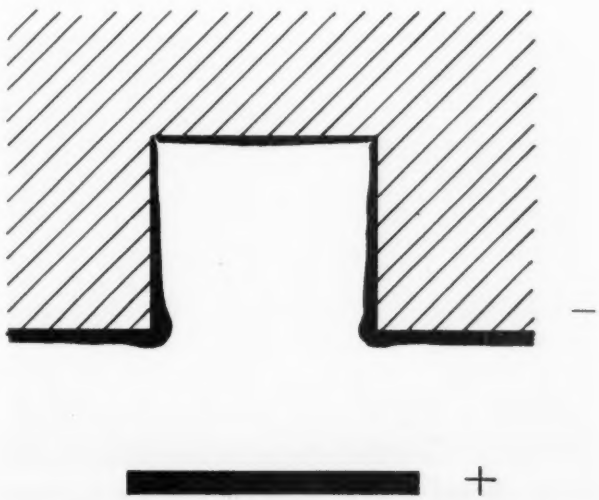


Figure 5. Plating in a Recess Enclosed on Three Sides.

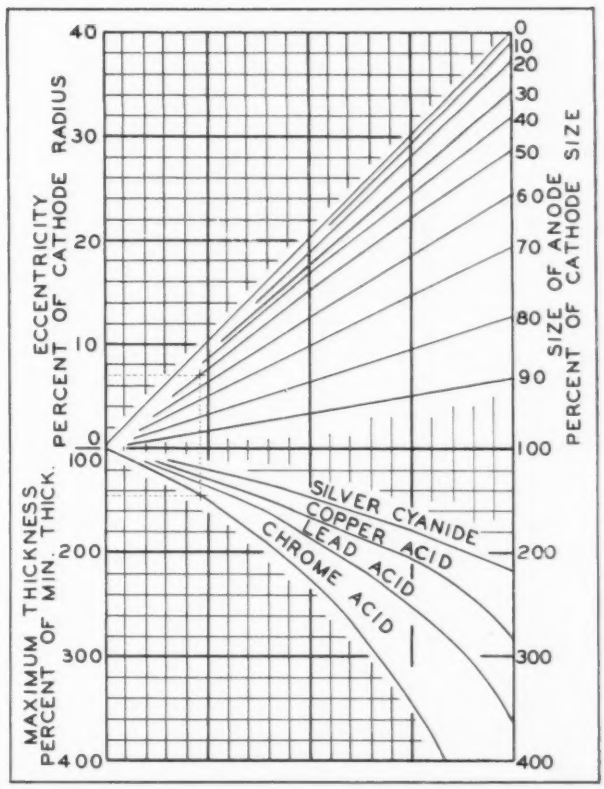


Figure 6. Chart for Anode Tolerance Location for Plating on the Inside of a Cylinder.

offered other than to provide a sufficient radius. Experimental studies under A.E.S. Research Project No. 11[7] show that, for a fillet radius less than .020", plating in corners becomes difficult.

The case for eccentric cylinders[4] can be presented as a single graph, as shown in Figure 6. This graph indicates the maximum variation in metal content that may be expected for any tolerance in location of the anode while plating on the inside of a cylinder. The dotted line shows that for an anode size 50% of the cathode size and an anode eccentricity of 7% of the cathode radius, the deposit will be 1.45 times as thick at the near point as at the far point in a chromic acid bath. It can be seen that a confined anode must be accurately located to obtain reasonably uniform deposits. It can also be seen that the problem is much more critical for large internal anodes and for baths of low throwing power.

The numerical values for throwing power are empirical. If enough data are taken for typical cases it is likely that an empirical set of rules, graphs, and charts can be established to define geometric limitations and to relate these to the throwing power of the plating baths.

References

1. W. M. Tucker and R. L. Flint, Trans. Electrochem Soc., **88**, 338 (1945). Metal Finishing, **44**, 340 (1946).
2. H. E. Haring and W. Blum, Trans. Electrochem. Soc., **44**, 313 (1923).
3. Metal Finishing, **46**, 59 (1948).
4. R. A. Schaefer and J. B. Mohler, Trans. Electrochem. Soc., **86**, 431 (1944).
5. C. Kasper, Trans. Electrochem. Soc., **78**, 155 (1940).
6. G. F. Kinney and J. V. Festa, 41st Conv. Proc. Am. Electroplaters' Soc. 66 (1954).
7. Plating, **40**, 899 (1953).

The Structure of Electrodeposited Metals

By Rolf Weil and Harold J. Read

This is the third and final installment of the series by Messrs. Weil and Read—Ed.

ZINC DEPOSITS:

The solutions for zinc deposition are similar to those used for copper. It is therefore logical to assume that certain similarities should also exist in the structure of the deposits. The deposits from the zinc sulfate bath, like those of copper, are composed of large columnar grains which contain platelets. The platelets in one zinc grain are shown in Fig. 29. It is not possible to find a correlation between the grain size, as shown by electron-microscopy or by visual observation and any of the plating conditions.

The structures of the deposits from the cyanide zinc bath are shown in Figs. 30, 31 and 32. It is seen that the type IC structure pictured in Fig. 30 results from deposition at the low current density, whereas the IIB structure is present in the specimen prepared at high current density. The type IC structure is identical to that obtained in the sulfate bath. The result of electron microradiography applied to the IC cyanide-zinc structure is shown in Fig. 33. Again the platelet structure exhibited by the replica is confirmed by the thin metal film. The higher-current-density structures are also composed of plate-like formations, which are more randomly arranged. The structures are designated as IIB, for most of the crystallites show a preferred direction of growth in the surface plane. Although the type II structure is not observed in deposits from the acid bath, it has been reported by Smith[4] in deposits from a zinc sulfate bath of the same composition as the one used here with the exception that licorice had been added.

It is quite obvious that a structure as rough as that of the high-current-density cyanide zinc deposits should appear matte, whereas the regular platelet arrangement of the type IC structure should be able to reflect light. Grains of the type IC deposits are too coarse, however, to appear bright to the eye. The type II structures are much finer than those designated IC, thus making the former appear smooth. The electron microradiograph of a type IIB structure from a cyanide zinc bath is shown in Fig. 34. Again the random plate-like formations are observed:

CADMIUM DEPOSITS:

The microstructures exhibited by the acid cadmium deposits closely resemble the structures of the corre-

Fig. 29. Electron micrograph showing structure type IC, acid zinc bath, 5.0 amp./dm.^{2}, pH 3.8, 26°C. 15,000X.

Fig. 30. Electron micrograph showing structure type IC, cyanide zinc bath, 0.5 amp./dm.^{2}, 24°C. 7,500X.

Fig. 31. Electron micrograph showing structure type IIB-6, cyanide zinc bath, 5.0 amp./dm.^{2}, 24°C. 15,000X.

Fig. 32. Electron micrograph showing structure type IIB-6, cyanide zinc bath, 5.0 amp./dm.^{2}, 55°C. 15,000X.

sponding zinc deposits. There is a difference, though, between the two metals. The cadmium plate does not cover the basis-metal completely. As soon as the deposits were removed from the plating bath, they appeared pink. Although there are reports in the literature indicating a very high diffusion rate of copper in cadmium deposits, it is unlikely that sufficient copper from the basis-metal could have diffused through the cadmium in the short time of plating to give the pink appearance. It was also noted that the deposits plated at 0.5 amp./dm.^{2} (5 amp./ft.^{2}) were more coppery in color than those plated at the higher current density. The reason for the pink color became evident on electron microscopic examination. The structure of the high-current-density deposit is shown in Fig. 35. The black portions between grains represent thick areas in the collodion replica or valleys in the sample. The replica indicates, therefore, that cadmium deposits in such a way that the basis metal is not covered in some intergranular areas. The low-current-denstiy deposits have even wider intergranular spaces where the basis-metal is not covered than are shown in Fig. 35. The platelet structure is quite pronounced in all acid cadmium deposits. An attempt to find relationships between the plating variables and grain size or brightness ofter than the one between current density and basis-metal coverage proved unsuccessful.

The structure obtained in the cadmium cyanide bath at 5 amp./dm.^{2} (50 amp./ft.^{2}) and 55°C. (131°F.), shown in Fig. 36 is classified IC, in spite of the fact that the surface does not appear crystalline, because the microstructure is like that of the IC deposits from the acid bath. The cyanide deposit, however, covered the basis-metal. The other plating conditions in the cadmium bath result in more unusual structures. The low-current-density deposits show colonies of platelike formations. Figs. 37 and 38 picture these colonies. The structures, like the IIB type in zinc, consist of platelets rather randomly arranged, which results in crystallites having a preferred growth direction in the plane of the surface. The deposit plated at 5 amp./dm.^{2} (50 amp./ft.^{2}) and room temperature consists of a fine plate-type matrix with larger crystallites, again composed of platelets. The larger crystals are shown in Fig. 39. Except for the platelets being in the long direction, the crystals in Fig. 39 appear almost acicular. Thinner deposits 0.04 mil thick plated at 2.5 amp./dm.^{2} (25 amp./ft.^{2}) and 25°C. (77°F.), shown in Fig. 40, again have the platelet structure although some areas look like the acicular type seen in nickel and cobalt.

Discussion and Conclusions

On the basis of the results of this work it is now possible to postulate a theory for the growth-behavior of the surface structures of electrodeposits. First it should be noted that the type II deposits are obtained only from zinc, cadmium, cobalt, and all-chloride nickel baths. The first two metals have a hexagonal

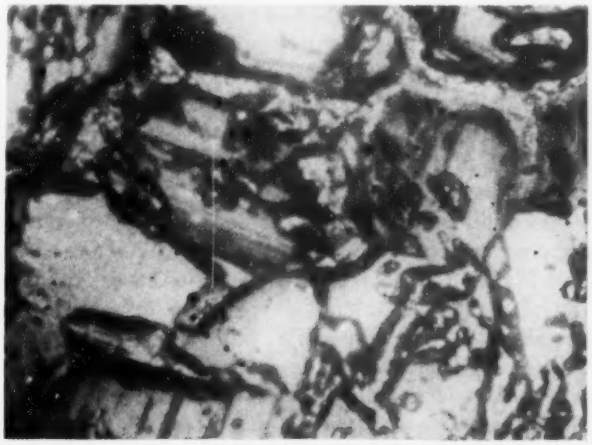


Fig. 33. Electron microradiograph showing structure type IC, cyanide zinc bath, 0.5 amp./dm.^{2}, 55°C. 7,500X.

Fig. 34. Electron microradiograph showing structure type IIB-6, cyanide zinc bath, 5.0 amp./dm.^{2}, 25°C. 15,000X.

Fig. 35. Electron micrograph showing structure type IC, acid cadmium bath, 5.0 amp./dm.^{2}, pH 5.0, 23°C. 7,500X.

lattice structure. Cobalt has been shown to be partly hexagonal, and it appears that the all-chloride nickel structures which belong to type II also have a mixed, cubic and hexagonal, lattice habit.

Many authors, such as Fink[5] and Macnaughtan, Gardam, and Hammond[6] believe that nickel deposits from a basic cathode film containing colloidal hydroxides. By analogy it can be assumed that cobalt behaves similarly to nickel. The influence of the hydroxides should be more pronounced in the presence of the colloid-flocculating chloride ion. The formation of colloidal hydroxides in the cathode film of cyanide baths has also been postulated by some investigators, and can easily be visualized in view of the high pH of such solutions. It is thus seen that the type II deposits only occur in baths which are believed to contain hydroxides, at least in the cathode film. It will also be recalled that addition agents added to an acid zinc bath give a type II structure.

From the above it can be concluded that two conditions must be fulfilled to give a type II structure, namely, the cathode film must contain substances which interfere with crystal growth, and the lattice must be at least partly non-cubic. There are, however, several deposits in which the two conditions are fulfilled, but which, nevertheless, belong to class I. It seems, therefore, that either additional conditions must be met or that a critical amount of growth-interfering substance must be present to give the type II structure. If the latter condition is assumed, it is possible to account for the observed structures.

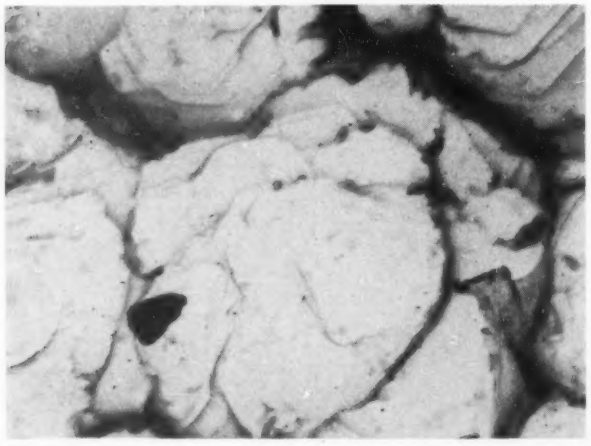


Fig. 36. Electron micrograph showing structure type IC, cyanide cadmium bath, 5.0 amp./dm.^{2}, 55°C. 15,000X.

Because the potential in a plating bath is in the direction of current flow, deposition should proceed in this direction. If growth is relatively unobstructed, the nuclei favorably oriented in the direction of current flow will grow into large columnar grains, thus yielding structural type IC. Fischer[7] pointed out that columnar grains become narrower when increasing amounts of foreign materials are present. Thus cubic metals, which tend to grow isotropically, should form fine, rather equiaxed grains in the plane of the surface. This explains type IB. In non-cubic metals there may be a preferred direction of growth not parallel to the current; hence, when critical amounts of colloidal substances are present, growth may be greater in a direction other than that parallel to the current. This leads to type II structures. If the amount of growth impedance is less than the critical value, then even in an isotropically-growing crystals, deposition is a maximum in the current direction and type IB structures result. When the quantity of colloidal substances is in excess of that needed to give the class II structures, growth is almost equally obstructed in all directions

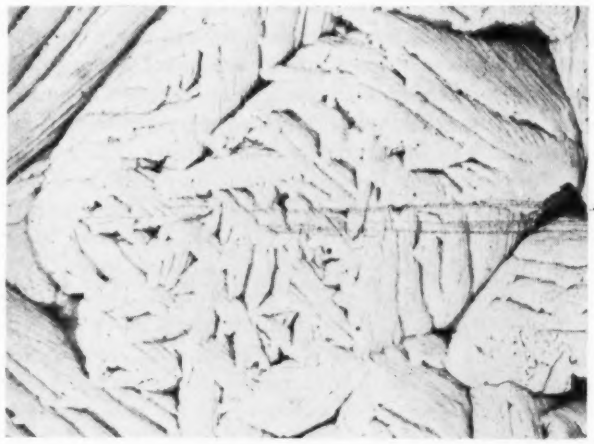


Fig. 37. Electron micrograph showing structure type IIB-7, cyanide cadmium bath, 0.5 amp./dm.^{2}, 24°C. 5,000X.

in the surface plane, thus again giving type I structure. Mixed structures may form when the quantity of colloidal material is very close to the critical value, so that this quantity can be reached in certain locations.

There are a number of observations which confirm the above hypothesis. Assuming, as most authors do, that the colloid content of the cathode film is increased by increasing pH, decreasing temperature, and increasing current density, it can be seen that the conditions for the formation of type II structure follow from a consideration of the plating variables. In the nickel all-chloride bath a low-current-density and low-temperature combination and a high-current-density and a high-temperature combination gave the type II structure. The two sets of plating conditions are roughly equivalent in their influence on colloid formation. In the cobalt Watts and all-sulfate baths the type II structure again formed at sets of plating conditions which are approximately equivalent in regard to colloid formation, namely, low pH and high temperature and high pH and low temperature. The same combination at a different current density results in the acicular struc-

ture in the cobalt all-chloride bath. The fact that when the third plating variable is also changed, the type I structure forms, supports the theory that a critical amount of colloidal material is needed to cause the formation of the type II structures.

The factors which determine the brightness of electrodeposits have received considerable attention in the literature. The most common generalities concerning brightness which have been proposed are that the greater the fibering or preferred orientation, the brighter the deposit; and that the grain size of the deposit has to be finer than the wave-length of light. Wood,[8] for example, reported that increased orientation gives brighter deposits. However, Smith, Keeler, and Read,[9] after examining a large number of specimens, found no specific relationship between orientation and brightness. Wittum,[10] as well as others, stated that a grain size smaller than the wave-length of light is needed for bright deposits. Read and Weil,[11] however, found no general relationship between grain size and brightness.

The formation of platelets in electrodeposits has been explained by Fischer[13,14] as follows: A two-

Fig. 38. Electron micrograph showing structure type IIB-7, cyanide cadmium bath, 0.5 amp./dm.^{2}, 55°C. 7,500X.

dimensional nucleus forms at a place of high energy, spreads over an area of the surface, and also grows in the direction of the current. As deposition continues, polarization on the surface parallel to the basis metal increases, mainly because of adsorption of foreign materials, until the surface becomes passivated. The crystal then grows on the faces parallel to the current, but at the same time the polarization on the plane parallel to the basis metal decreases. Then as impurities gather on the growing sides, they become passivated, and deposition on the original face can continue again. This cyclic behavior leads to the formation of platelets.

It appears that the size and the orientation of the platelets in addition to the grain size influence the brightness of the deposit. Blum, Beckman, and Meyer[12] pointed out that coarse-grained deposits can be bright, if the surface can reflect light. Most of the type I structures have platelets in the plane of the surface or slightly inclined to it which can reflect light. It is reasonable to assume that brightness is determined by the smoothness of the surface, and from the results of the present investigations it has been concluded that a surface may be smooth because of fine, uniform grains or

Fig. 39. Electron micrograph showing structure type IIB-7, cyanide cadmium bath, 5.0 amp./dm.^{2}, 24°C. 7,500X.

because of platelets all of which are approximately in the same plane in grains of any size.

Summary

1. The surface structures found in several electroplated metals deposited under a variety of conditions have been classified, and the development of the structures from a polished basis metal were studied.
2. The structural type for given deposit is reproducible, indicating that it is truly a function of the bath and plating conditions.
3. A theory has been proposed to account for the formation of the various structural types. It is based on a consideration of the lattice structure of the plated metal and the quantity of growth-impeding material in the cathode film.
4. The lattice structure of some nickel and cobalt deposits were determined.
5. It was suggested that the brightness of the deposits is determined by the grain size and the platelet orientation in grains of any size.

Acknowledgement

The electron micrographs were taken by *Miss Ethel J. Senkovits* in the high-magnification laboratory in the School of Mineral Industries of the Pennsylvania State College.

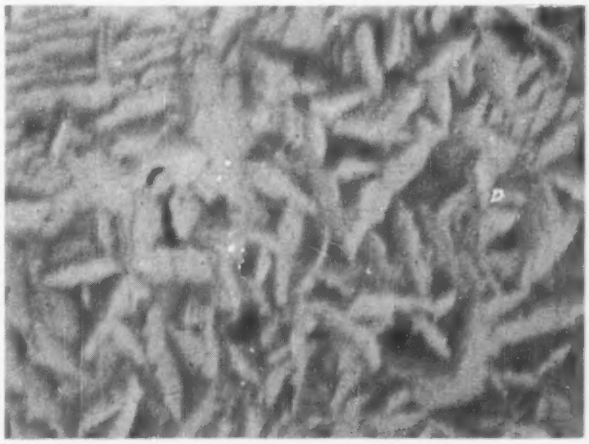


Fig. 40. Electron micrograph showing structure type IIB-6, cyanide cadmium bath, 2.5 amp./dm.^{2}, 25°C., (1×10^{-4} cm. thick). 15,000X.

Finishing Pointers

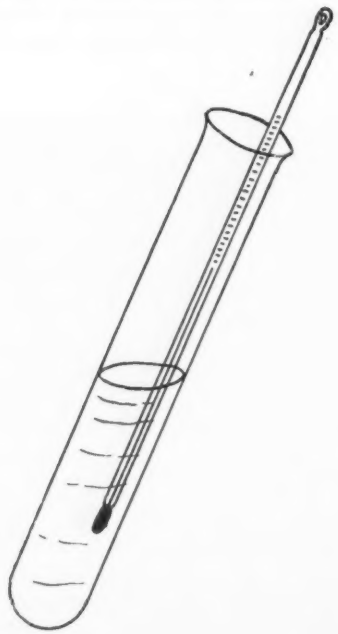
Control of Salt Content by Crystallization

MANY of the alkaline baths have a practical limit for tolerance of carbonate. As an example, the copper cyanide baths build up in sodium carbonate due to decomposition of cyanide and to absorption of carbon dioxide from the air. A moderate amount of carbonate will increase the plating range of such a bath but an excessive amount will decrease the plating range. Consequently, an economic control procedure will often include means to control the carbonate concentration. Crystallization is one method of control.

If an alkaline bath is made up of sodium salts the salts are sufficiently limited in solubility that crystallization is a possibility. If such a bath is operated hot and at fairly high total salt concentrations, sodium carbonate may crystallize on cooling to room temperature. Also, if the bath is exposed to steel and particularly to steel that is anodic, iron may build up in the bath so that sodium ferrocyanide can be crystallized.

If the bath is one, such as the high efficiency copper cyanide bath, where crystallization is a possible method for control, then a method of estimating the crystal yield will be useful. There are several simple ways to determine if the bath is sufficiently concentrated to make crystallization worth while.

A rapid check can be made by cooling a sample in a test tube and observing the temperature at which crystallization starts. If this is done carefully an estimate of the crystallization temperature can be made within a few degrees. To do this, start with a warm solution and cool the test tube with running water under a tap. As the solution cools keep scratching the side of the test tube with the thermometer and watch for crystals to form. If the crystals come down in a shower it means that the solution was supercooled and the temperature at this point is lower than the maximum crystallization temperature. If this happens slowly, warm the test tube and observe the point at which the crystals just dissolve. Now start at this temperature and cool again but place a few crystals of sodium carbonate just above the solution level. By heating and cooling the crystallization temperature can be estimated.



If the crystallization temperature is 80°F. it would mean that natural cooling of the bath to room temperature would result in very little crystallization. In the summer time it may not be possible to cool to this temperature. If the crystallization temperature is substantially above this then it may be possible to remove an appreciable amount of salt by natural cooling.

Natural cooling of the bath followed by decantation and removal of the crystals is the most convenient way to reduce the carbonate content. If conditions are favorable, the bath can be cooled over the weekend and the crystals removed on Monday morning.

Several things can be done to increase the crystal yield. The more concentrated the bath, of course, the greater will be the yield. If the crystallization temperature indicates that some salt may be removed but not enough to be worth while, then the bath can be concentrated. One method of concentrating the bath is by evaporation. If the bath is operated hot, it can be allowed to evaporate to a minimum operating level while being used and to a lower level after use is discontinued. Another thing that can be done is to increase the amount of the other salts used in the bath. All of the other chemicals can be added to an amount slightly above the maximum for each. This will bring the total concentration up and reduce the solubility of sodium carbonate, thus increasing the potential crystal yield. The other chemicals should be added above the maximum for the maximum bath level. There will be some loss of other chemicals in the crystal mass so that, even though they are above the maximum, they will be in limits after the crystals are removed.

It will take some experience to use this method. If addition of chemicals and concentration are carried to an extreme, the resulting crystal mass on cooling will be too bulky to handle and will trap an excessive amount of solution.

An estimation of the bulk of the crystal mass in comparison to the volume of solution can be made by cooling a sample of the bath to room temperature in a beaker and observing the amount of crystallization. After cooling and crystallizing a sample, it will be helpful to measure the gravity of the solution. The gravity should be measured at a specific temperature. Now a second sample of the bath can be taken and diluted with water until this same gravity reading is obtained at this same temperature.

By the use of the crystallizing temperature and by the use of gravity obtained after crystallization and by dilution, data can be accumulated to estimate the crystal yield. By evaporation and concentration experiments an estimate can be made of the character of the crystal mass. By small scale crystallization the actual crystal yield can be determined in advance. The crystal product can then be analyzed to determine what amount of salts other than sodium carbonate and sodium ferrocyanide may be removed.

Science for Electroplaters

10. Standard Solutions

By L. Serota

SOLUTIONS are prepared by using definite quantities of solute and solvent in a solution of fixed volume. A number of methods are employed to express such concentrations. The concentration of a solution represents the weight of the solute (as acid, alkali or salt) dissolved in a given weight or volume of the solution. Water is the common solvent. Plating solutions are usually expressed in terms of ounces of material dissolved in a gallon of solution (oz./gal.). Values in the metric system given as grams per liter (g./l.) are usually included. Some examples follow: nickel sulphate, $NiSO_4 \cdot 6H_2O$, for a nickel bath; 16 oz./gal. (120 g./l.); sodium carbonate, Na_2CO_3, for a cleaning bath; 3 oz./gal. (23 g./l.); sulphuric acid, H_2SO_4, for a bright dip for brass: 55 fl. oz./gal. (800 g./l); sodium dichromate, $Na_2Cr_2O_7 \cdot 2H_2O$, for an electropolishing solution: 56 oz./gal. (420 g./l.).

Standard solutions used in control of plating baths may be expressed in terms of 1. Percentage, 2. Molarity, 3. Normality.

Percentage

When a solution is prepared by dissolving 5 grams of caustic soda (solute) in 95 grams of water (solvent), the fraction of the solute in the solution would be 5 parts in 100 or 5/100 or 0.05. Expressed as per cent, it would be $\frac{5}{100} \times 100 = 5\%$ caustic soda solution. Examples of this form of standard solution in plating operations and analysis are as follows: for the analysis of carbonate in cyanide solutions, a 10% barium nitrate, $Ba(NO_3)_2$, solution is used; for the determination of free cyanide in a cyanide bath, a 10% potassium iodide, KI, solution is used; metallic cadmium analysis requires a 15% sodium sulphide, Na_2S, solution; 66° Baumé (Bé), specific gravity 1.8354, sulphuric acid contains 93.19% H_2SO_4; and muriatic (hydrochloric) acid, 19° Bé, specific gravity 1.1508, contains 30.16% HCl. The weight of a gallon of acid may be determined from the specific gravity of the acid. The weights of the H_2SO_4 and HCl per gallon may be calculated from the percentages given. (A gallon of water weighs 8.34 pounds.

Specific gravity × *weight of 1 gal. H_2O* = *weight of 1 gal. acid*

66° Bé. H_2SO_4 = 1.8354 × 8.34 = 15.3 pounds acid
19° Bé. HCl = 1.1508 × 8.34 = 9.6 pounds acid

$$\textit{Weight of 1 gal. acid} \times \frac{\textit{per cent acid}}{100} = \textit{weight of acid/gal.}$$

66° Bé. H_2SO_4 = 15.3 × 0.9319 = 14.2 lbs. H_2SO_4
19° Bé. HCl = 9.6 × 0.3016 = 2.9 lbs. HCl

The values for the weight of a cubic foot of each acid may be obtained by substituting 62.43 pounds (weight of 1 cu. ft. water) for 8.34 in the above equation.

Molarity

For molarity the concentration is expressed in terms of moles of solute per liter of solution. A *mole* is defined as the amount of material numerically equal to its molecular weight. When this value is expressed in grams the term is known as a gram-molecule (mol). In engineering computations a larger value, the molecular weight expressed in pounds and known as the pound-molecule ((lb. mol), is used. A (gram) molar solution of sulphuric acid H_2SO_4 would contain 98 grams (molecular weight) in one liter of solution; a 2 molar (2M) solution of sulphuric acid would contain 196 g./l. of H_2SO_4 and a ½ molar (0.5M) of this same acid would contain 49 g./l. of H_2SO_4. A formula for electropolishing brass gives the composition of the ingredients in molar quantities in addition to the values expressed as grams per liter and ounces per gallon. The amount of phosphoric acid, H_3PO_4 (sp. gr. 1.75), in this formula, for example ,is recorded in the following manner: 1.8M; 200 g./l.; 27 oz./gal. For the analytical determination of chromic acid it is convenient to use this molar term in calculations. When the concentration is expressed by this method confusion is avoided, since chromic acid may be classified as both an acid and an oxidizing agent. A molar solution of chromic acid CrO_3 (mol. wt. = 100) would contain 100 g./l. It is also convenient to use the term molar solution for substances such as (sugar) dextrose, $C_6H_{12}O_6$, that do not ionize. A molar solution of this sugar will contain 180 g./l.

Normality

The solution used most extensively in analytical procedure, the normal solution, is based upon the use of one gram-equivalent weight of the solute per liter (1000 milliliters) of solution. The gram-equivalent weight of a substance represents the weight in grams of a material (element or compound) corresponding to or causing the reaction of a gram atom (the weight of an atom of hydrogen in grams) of hydrogen, 1.008 grams. When a liter (1000 ml.) of solution contains the equivalent weight of a reagent it is known as a *normal* solution.

In a neutralization reaction, such as $HCl + NaOH \rightarrow NaCl + H_2O$, the gram-equivalent weight of HCl (1 + 35.5 = 36.5) would be 36.5 grams. This is so because the molecular weight of HCl is sufficient to bring into reaction 1 gram-atomic weight (1.008 grams) of hydrogen. A normal solution of this acid would therefore contain 36.5 grams of HCl dissolved in one liter of solution. A normal solution of an acid, accordingly, contains 1.008 grams of replaceable hydrogen per liter. The gram-equivalent weight of NaOH as shown by this equation would be 40 grams because the molecular of this compound (40 grams) is sufficient to react with a gram-atom (1.008 grams) of hydrogen present in the HCl. A normal solution of sodium hydroxide would therefore contain 40 grams of NaOH dissolved in one liter of solution.

The neutralization of sodium hydrox-

ide by sulphuric acid will bring into reaction two grams of hydrogen.

$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$

Equivalent weights:

$(2+32+64)=98 \quad 2(23+16=1)+80$

Since the sulphuric acid by this reaction furnishes 2 gram-atomic weights of hydrogen, one half of the molecular weight of the acid is sufficient to provide the 1 gram (1.008) of hydrogen. $\frac{H_2SO_4}{2} = \frac{98}{2} = 49$ grams. A normal solution of sulphuric acid would therefore contain 49 grams (equivalent weight) dissolved in a liter of solution.

It is evident that the molecular weight, 36.5 grams, of the acid HCl (containing 1 gram of hydrogen) or half the molecular weight, 49 grams, of the acid H_2SO_4 (containing 1 gram of hydrogen) when dissolved in a liter of solution will, in each instance, represent normal solutions.

For determining the equivalents of salts the same procedure is followed. One gram-equivalent of a reagent dissolved in a liter of solution will give a normal solution.

Since calculations for analytical procedures are based upon the values represented in normal solutions, a table containing the concentrations of reagents commonly used will be helpful in understanding the methods used for such determinations. Table 1 lists such values. The column headed milliequivalent (me) represents the weight, in per cent of a gram, of one thousandth part of a liter of a solution containing the equivalent weight. The value for this volume (one milliliter) is very useful in analytical computations.

Weight-Volume Calculations

Standard solutions must be prepared with accuracy. The reagent should be of the highest purity and the apparatus used for this procedure is of special design. In Fig. 27 some of the common pieces of volumetric glassware required for routine analysis are shown. When a solid is used to prepare the solution it is weighed on a chemical balance, dissolved in distilled water, and diluted to the mark in a volumetric flask such as that shown in Fig. 1-D. When a solution of sulphuric, nitric or hydrochloric acid is prepared, the specific gravity and per cent of acid in the solution must be known. To calculate the weight or volume of sulphuric acid which has a specific gravity of 1.8354 and contains 93.19% H_2SO_4, required for the preparation of a normal solution (49 grams), the following procedure is used:

Weight:

$$\frac{\text{Weight of } H_2SO_4 \text{ required}}{\text{Per cent } H_2SO_4 \text{ in acid} \times 100} = \text{Weight of acid}$$

$$\frac{49}{0.9319} = 52.6 \text{ grams } H_2SO_4 \text{ (sp. gr. 1.8354)}$$

Volume:

$$\frac{\text{Weight } H_2SO_4 \text{ required}}{\text{Wt. } H_2SO_4 \text{ per ml.} \left(\frac{\text{sp. gr.} \times \%}{100} \right)}$$

$$\frac{49}{1.8354 \times .9319} = 28.65 \text{ ml. } H_2SO_4 \text{ (sp. gr. 1.8354)}$$

Since normal solutions contain equivalent weights, one liter (1000 ml.) of normal hydrochloric acid containing 36.5 grams of HCl is equivalent to one liter (1000 ml.) of normal sodium hydroxide containing 40 grams NaOH. In effect, one liter or any proportion of this value of normal (N) HCl will neutralize one liter or an equal portion of normal (N) NaOH.

(a) 1000 ml. N HCl, 36.5 g., are equivalent to 1000 ml. N NaOH, 40 g.

(b) 500 ml. N HCl, 18.25 g., are equivalent to 500 ml. N NaOH, 20 g.

(c) 10 ml. N HCl, .365 g., are equivalent to 10 ml. N NaOH, .40 g.

(d) 1 ml. N HCl, .0365 g., is equivalent to 1 ml. N NaOH, .040 g.

(e) 1000 ml. 2N HCl, 73 g., are equivalent to 2000 ml. N NaOH, 80 g.

(f) 1000 ml. .5N HCl, 18.25 g. are equivalent to 500 ml. N NaOH, 20 g.

(g) 500 ml. N H_2SO_4, 29.5 g., are equivalent to 500 ml. N NaOH, 20 g.

The general formula for determining the normality of a solution is therefore:

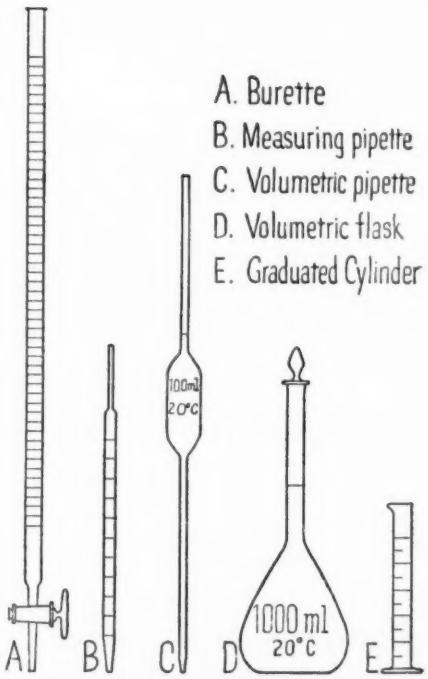


Fig. 27. Volumetric Glassware.

If it took 15.37 ml. of N HCl to neutralize 10.00 ml. of NaOH, the normality of the alkali would be

$$15.37 \times 1 = 10 \times N$$

$$N = \frac{15.37 \times 1}{10} = 1.54 \text{ or } 1.54 \text{ N}$$

The weight of the NaOH in the 10 ml. is determined as follows:

(a) From table 1, one ml. N NaOH (milliequivalent, me) contains 0.040 g. NaOH

(b) 1 ml. 1.54 N NaOH contains $1.54 \times 0.040 = 0.062$ g. NaOH

(c) 10 ml. 1.54 N NaOH contains $0.062 \times 10 = 0.62$ g. NaOH

The general formula for determining the weight of a reagent in a given amount of a solution is:

$$\text{ml.} \times \text{N} \times \text{me} = \text{wt.}$$

Substituting in step (c)

(c) $10 \times 1.54 \times 0.040 =$ 0.62 g. NaOH in 10 ml.

This weight of NaOH in 10 ml. may be stepped up to the weight of NaOH in one liter (g./l.) by multiplying by one hundred. The weight in grams per

	Acid			=	Base		
	milliliters	×	*normality*	=	*milliliters*	×	*normality*
or	ml.	×	N	=	ml.	×	N
(a)	1000	×	1	=	1000	×	1
(c)	10	×	1	=	10	×	1
(e)	1000	×	2	=	2000	×	1
(f)	1000	×	.5	=	500	×	1

Table 1. Normal Solutions

Compound	Formula	Mol. Wt.	Equiv. Wt.	Grams solute/liter N	0.5N	0.1N	Milli-equivalent (me) g./ml.
Hydrochloric Acid	HCl	36.5	36.5	36.5	18.25	3.65	0.0365
Nitric Acid	HNO_3	63	63	63	31.5	6.3	0.063
Sulphuric Acid	H_2SO_4	98	49	49	24.5	4.9	0.049
Sodium Hydroxide	NaOH	40	40	40	20	4.0	0.040
Silver Nitrate	$AgNO_3$	170	170	170	85	17.0	0.170
Sodium Cyanide	NaCN	49	49	49	24.5	4.9	0.049

liter when multiplied by 0.134 will give the weight of NaOH in ounces per gallon (oz./gal.).

Application of the two formulas is helpful in analytical calculations and in the interpretation of values expressed in such terms. For example, the quantities for bath compositions are frequently given in terms of normality, grams per liter, and ounces per gallon. In one formula the quantity of sodium cyanide in a copper cyanide bath is shown by the three values: 1.15 N; 57 g./l.; 7.5 oz./gal. The conversion in terms of normality to (a) grams per liter and (b) ounces per gallon is accomplished by the following steps. From Table 1, the milliequivalent for sodium cyanide NaCN is .049.

$$\text{ml.} \times \text{N} \times \text{me} = \text{wt.}$$

(a) $1000 \times 1.15 \times .049 = 56.4$ g./l. NaCN

(b) $56.4 \times .134 = 7.5$ oz./gal. NaCN

(g./l. $\times$ .134 = oz./gal)

The normality of an acid may be determined if the specific gravity and per cent of acid in the solution are known. The normality of muriatic acid, specific gravity 1.15 (30.16% HCl), is calculated as follows:

$$\text{weight of HCl} = 1.15 \times 0.3016 \rightarrow 0.35 \text{ g./ml.}$$

by substitution:

$$\text{ml.} \times \text{N} \times \text{me} = \text{wt.}$$

$$1 \times \text{N} \times 0.0365 = 0.35$$

$$\text{N} = \frac{0.35}{1 \times 0.0365} = 9.55 \text{ or } 9.55 \text{ N}$$

When a normal hydrochloric acid solution is prepared, the exact normality is determined by the neutralization (titration) of a definite quantity of a standard solution, such as sodium hydroxide. An indicator, such as methyl orange, is used to determine the point of neutralization by a sharp color change. This is called the end point. If 9.36 ml. of a solution of HCl of approximately one normal (N) neutralizes 10.00 ml. of a 1.0234 N solution of NaOH, the normality of the acid is determined as follows:

$$\text{ml.} \times \text{N} = \text{ml.} \times \text{N}$$

$$9.36 \times \text{N} = 10.00 \times 1.0234$$

$$\text{N} = \frac{10.00 \times 1.0234}{9.36} = 1.0934$$

The normality of the acid is 1.0934 N.

The conversion factor 0.134 for changing grams per liter to ounces per gallon is derived by the following procedure. A solution of one gram per liter may also be expressed as $\frac{1}{28.3495}$ ounce per liter (one ounce is equivalent to 28.3495 grams). One liter is equivalent to 0.2642 gallon, or one gallon is equivalent to 3.7853 liters. The product of 0.035274 multiplied by 3.7853 (0.035274 × 3.7853) is 0.134 which is the factor used in changing grams per liter to ounces per gallon.

Oxidation-Reduction

The determination of chromic acid involves the oxidation of the trivalent chromium to the hexavalent state, or the reduction of the hexavalent chromium ion to the trivalent state. These reactions represent a process in which an electron transfer takes place. The substance losing electrons is oxidized, and the substance gaining electrons is reduced. A normal oxidizing or reducing solution contains, in a liter of solution, the molecular weight of the compound, in grams, divided by the change in electrons lost or gained in the reaction. Ferrous ammonium sulphate is a reducing agent used in one of the analytical methods for determining the hexavalent chromium in a chromium bath. The ion changes in this reaction from the ferrous ion to the ferric ion, losing one electron. Fe^{++} (ous) $\rightarrow$ Fe^{+++} (ic) + e. For a normal reducing solution of this compound, the molecular weight (divided by one) would be dissolved in a liter of solution.

SHOP PROBLEMS

ABRASIVE METHODS SURFACE TREATMENTS CONTROL
ELECTROPLATING CLEANING PICKLING TESTING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Separating Films

Question: We manufacture phonograph record matrices and we are having some trouble separating the metal plates from each other We use an acid copper bath and potassium iodide for separating fluid. To give more information as to our process, I will list the different processes the plate goes through:

1. The plate is polished with red jewelers rouge
2. Cleaned with cyanide
3. Replacement silver is added (silver nitrate-cyanide)
4. Iodide
5. The plate is ready for the plating tank.

These plates are sticking together. We may run 20 plates one day and maybe 3 will stick. We have mixed new solutions with new chemicals. They still stick together. I have been told that there is a process using Iodine but I don't know the procedure.

C. M. C.

Answer: Phonograph record matrices are commonly nickel-faced to insure separation. If a light nickel deposit is applied to the master, a good separating film consists of 11 grams/liter potassium dichromate and ½ gram/liter of caustic soda applied for about 2 minutes.

The iodine process for separating copper matrices is as follows: Apply a solution of 5 oz./gal. silver cyanide and 12 oz./gal. sodium cyanide, either by dipping or rubbing in the solution mixed with powdered chalk. Rinse and apply a solution of the iodine-iodide. A stock solution contains:

Iodine	70 g.
Potassium iodide	50 g.
Water	50 ml.
Denatured alcohol to make one liter	

Use 1 fluid oz. per gallon of water.

Blackening Aluminum

Question: We are wondering if your "Shop Problems Dept." would have information which would permit the blackening of aluminum by any chemical or "salt" method? We would appreciate any information on a non-electrolytic blackening process that you might have.

W. C. N.

Answer: A commonly employed solution for blackening aluminum is as follows:

Ammonium molybdate	½-2	oz./gal.
Ammonium chloride	1-4	"
Ammonium acetate	1-2	"

This solution is used at boiling for 1-3 minutes.

Hard Nickel and Anodizing

Question: We would appreciate any data on hard nickel and hard anodize.

G. J. B.

Answer: Complete information on hard nickel plating will be found in any recent edition of the METAL FINISHING GUIDEBOOK in the section on nickel plating.

Hard anodizing is performed in 12-15% sulfuric acid solutions, with or without a small amount of oxalic acid. The process differs from ornamental anodizing in that very low operating temperatures and high voltages are required. A 1,000 ampere installation requires about 20 tons of refrigeration. Patents on these processes are owned by Aluminum Co. of America and Glenn L. Martin Co.

Spotting Out of Silver

Question: We are having trouble with silver spotting out after plating. We are using a bright potassium cyanide silver solution. We have tried hot water rinse between the cleaner and acid dip and also after plating a double hot water rinse. We have also tried an acid dip after plating, with no success. The cleaner we use is our brass cleaner with a little direct current after brushing. Any suggestions which you can give us or help in clearing up our trouble will be appreciated.

R. R. F.

Answer: Spotting out of silver may be due to a number of conditions, including dirt in the plating solution and water supply, hardness of the water, improper use and composition of the silver strike. These possibilities can be investigated.

A good bake at about 225 deg. F. for about 15 minutes will often minimize spotting out.

Hot Tinning

Question: We are interested in improving the method of stripping the excessive tin off the cream cans after they have come out of the tinning bath.

We also use tallow at about 500-550 degrees, with a flash point of 600°, to remove the surplus tin from the cream cans, and we want to get away from this fire hazard. What else can we use to remove the excessive tin that would not have to be at such high temperatures, or materials that would be considerably less hazardous?

C. L. S.

Answer: To avoid the problem of the fire hazard in connection with the use of tallow or other oils for flowing tin, you might consider the use of an oven. The oven temperature could be controlled to within a few degrees of the melting point of tin.

Further information on the subject may be obtained by communicating with the Tin Research Institute, 492 West Sixth Ave., Columbus 1, Ohio.

Lacquering Plated Wire Goods

Question: In your magazine METAL FINISHING, Sept. 1954 issue, on page 86 under "Spot Free Drying" you mention "precipitating" thinner. Is this the same as water dip lacquer?

On our bright brass plated wire goods we are faced with somewhat of a tarnishing problem, and we wonder if there is any way of eliminating this. From the brass tanks the articles come out with a wonderful brass color, are rinsed, sawdust dried, and then spray lacquered with a 50-50 concentration, then air dried. Subsequently, upon standing, we notice a tarnishing, but not all the articles are tarnished. We wonder if you can help us?

M. J. H.

Answer: A precipitating thinner is only a thinner, not a lacquer. Therefore, it is not the same as a water dip lacquer, although both have the same action, namely displacing the water film from the article.

Spray lacquering of wire goods is not very effective, since areas of the wire do not receive sufficient thickness of lacquer to resist penetration by moisture from the atmosphere.

We would suggest that you use a dip lacquer for the purpose. However, if spraying is required, the electrostatic process should be employed.

Relieving Silver in Bulk

Question: We are experiencing considerable difficulty in successfully relieving silver plated parts after oxidation by barrel burnishing. We find it necessary to plate a very heavy deposit of silver on the articles which are then oxidized using a tellurium oxidizing solution. The parts are then relieved in the burnishing barrel using steel shot pins and pumice.

We would like to know if you can suggest a compound which we might use after oxidizing that would not remove as much silver from the plated pieces after oxidation. In other words, we believe we are plating an unnecessary quantity of silver in order to get the desired finish. We have found that by reducing the tumbling time, the oxidation is not properly removed.

R. C. H.

Answer: Substitution of dry sawdust tumbling for the present method employing steel shot and pumice may reduce the abrasion of the silver deposit. Addition of a suitable burnishing compound may also give satisfactory results. A list of suppliers of barrel finishing supplies will be found on page 551 of the latest edition of the METAL FINISHING GUIDEBOOK.

Gold Analysis

Question: Please note that the method for gold analysis in cyanide baths, page 488, 22nd annual GUIDEBOOK - DIRECTORY, is incorrect. The thiosulfate determination depends on the presence of trivalent gold, i.e.

$$Au^{+3} + 2I^- \rightarrow Au^+ + 2I^\circ$$
$$2I^\circ + 2Na_2S_2O_3 \rightarrow 2I^- + Na_2S_4O_6$$

Since HCl does not convert Au^+ (in $KAu(CN)_2$) to the trivalent state your method cannot give correct results.

If aqua regia is used, correct results can be obtained under carefully controlled conditions.

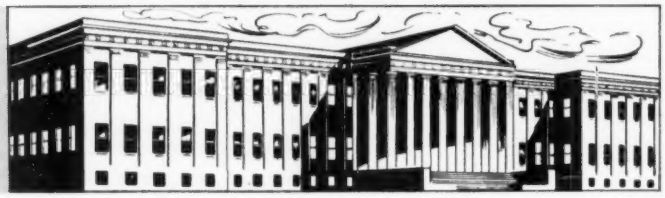
E. L.

Answer: The formulas are correct, but aurous chloride decomposes quite readily at elevated temperatures to the auric form. During the period of boiling the acidified sample to a syrup, the gold is oxidized to the trivalent form, so that the titration with thiosulfate, after adding potassium iodide, is satisfactory.

Use of aqua regia instead of CHl is not advisable since, if all the nitric acid is not boiled off, inaccurate results will be obtained.

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD



Electrolytic Polishing of Aluminum

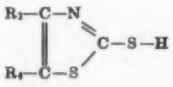
U. S. Patent 2,708,655. *May* 17, 1955. *H. L. Turner, assignor to Union Carbide & Carbon Corp.*

A process of producing a smooth, lustrous surface on an article of aluminum-rich alloys, said process comprising said article in an electrolyte at a temperature of from 60°C. to 100°C., said electrolyte comprising, by weight, 45% to 80% orthophosphoric acid, 5% to 20% sulfuric acid, the total of the two acids being not more than 90% of said electrolyte, 3% to 15% of an organic compound selected from the group consisting of aliphatic polyalcohols and ether-alcohols soluble in phosphoric acid, and the remainder water, etching said article in said electrolyte, and then subjecting said article to a direct current voltage while making said article an anode in said electrolyte.

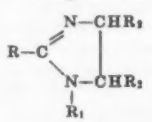
Soluble Oil Rust Inhibitors

U. S. Patent 2,708,660. *May* 17, 1955. *S. E. Jolly, assignor to Sun Oil Co.*

A mineral soluble oil capable of forming stable emulsions in water and containing an emulsifying agent and a rust-inhibiting quantity of an additive material selected from the group consisting of: salts of (1) a 2-mercaptothiazol selected from the group consisting of mercaptobenzothiazol and compounds having the formula:



where R_3 and R_4 are each selected from the group consisting of hydrogen and lower alkyl radicals and (2) an imidazoline having the formula:



where R is an aliphatic hydrocarbon radical of a naturally occurring fatty acid, said radical having 8 to 20 carbon atoms, R_1 is a radical having molecular weight less than about 75 and selected from the group consisting of hydrogen atoms, alkyl hydrocarbon radicals, hydroxyalkyl radicals, and aminoalkyl radicals, and R_2 is selected from the group consisting of hydrogen and lower alkyl radicals; physical mixtures of such imidazoline and an alkkali metal mercaptide of such 2-mercaptothiazol; and physical mixtures of such imidazoline and an alkaline earth metal mercaptide of such 2-mercaptothiazol.

Cleaning Metal Strip

U. S. Patent 2,709,142. *May* 24, 1955. *G. Durst, assignor to Metals & Controls Corp.*

The method of cleaning a surface of a metal strip preliminary to solid phase bonding thereof with another strip, comprising positively feeding the strip over the periphery of a rotary scratch brush, positively rotating the brush to effect relative movement between the strip and the periphery of the brush, and causing the brush to penetrate the strip, the speed of the strip, the speed of the brush, and the penetration of the brush being such as to frictionally heat the surface of the strip to a temperature sufficiently high to drive off such contaminants as organic matter, moisture and adsorption films, while abrading off oxide and other inorganic films, without heating the bulk of the strip to such temperature, and so that the temperature of the strip immediately after it passes the brush is below that at which visible oxide film rapidly forms on the newly brushed surface.

Pickling and Spent Acid Recovery

U. S. Patent 2,709,143. *May* 24, 1955. *C. B. Francis and E. Lynch, assignors to U. S. Steel Corp.*

The method of continuously pickling steel which comprises removing the spent acid solution from the entry end of the pickling line, exposing the solution to air at atmospheric temperature to cool the liquid to a temperature below 110°F., expanding compressed air cooled to at least approximately — 100°F. into a chamber containing the partially cooled liquid to cool the liquid to a temperature below 20°F., collecting the cold solution and permitting it to stand until salt crystals of the desired size have formed, separating the crystals from the liquid, heating the liquid from which the salt has been separated by exposing it to the compressed air prior to its expansion into the chamber, returning the reheated solution into the opposite end of the pickling line and passing steel through the pickling line.

Corrosion Resisting Coatings

U. S. Patent 2,709,154. *May* 24, 1955. *F. J. Hansgirg, assignor to American Electro Metal Corp.*

The method of providing a shape-retaining body of a base metal selected from the group consisting of molybdenum, tungsten, molybdenum base alloys and tungsten base alloys with a protective coating which will remain substantially free of corrosion when exposed to high temperature combustion gases within the interior of a combustion engine which method comprises placing the body in a molten electrolyte bath containing aluminum compounds and maintained at a high temperature between about 900°C. and 1,100°C., passing a high current density electric current from an anode in said bath to said body as a cathode, held heated in said bath at said high temperature, and depositing aluminum on the exterior of said body and thereby causing the deposited aluminum to combine with the base metal of the body into a protective coating containing at least one continuous, dense, oxygen-impervious intermetallic compound layer between the base metal and aluminum, and removing substantially all free aluminum remaining on the exterior of said body.

A SPECIAL REPORT ON PROTECTIVE FINISHES FOR ALUMINUM

Most aluminum producers and fabricators are well aware of the superiority of chemical finishes over anodizing for the protection of aluminum from corrosion. Naturally, then, there is a running battle for acceptance among the leading producers of the protective chemical finishes.

That's why, here at Allied, we have always studied your needs with regard to both our own and competitive processes. We're constantly trying to produce new and better finishes because we believe there's always room for improvement . . . even to our own products. Some years ago this policy led to the introduction of a process, long in development, that offered you a way to overcome anodizing's obvious technical complications . . . Iridite #14. This finish was far easier to use than anodizing, yet provided comparable, if not superior, quality. And, its cost was much less than anodizing.

But other finishes offering similar advantages over anodizing have entered the market. So . . . the current battle for acceptance. By any cost comparison Iridite #14 is the most economical. However, corrosion tests by users show contradictory results as to performance from Iridite #14 and other leading protective finishes for aluminum. Most tests show Iridite #14 superior, but some do not. The margin of difference, however, is always small. The truth is that all have proved good. However, our laboratory research indicated that still further improvements could be made.

That knowledge . . . plus our aim to give you even better protection and maintain the leadership of the industry, is exactly why Allied Development Engineers have been working for long years to develop a better finish than any of those now available, including our own Iridite #14.

Now the new finish is ready for you. It's called Iridite #14-2 (Al-Coat).

From a performance standpoint, Iridite #14-2 gives you two important advantages in the protective finishing of aluminum.

FIRST: in its fully colored brown film stage it provides corrosion resistance decidedly superior to previous processes.

SECOND: the basic brown film can be hot water bleached to produce a clear-type film with protection heretofore unobtainable from clear-type chemical finishes.

From an operating standpoint, new Iridite #14-2 gives you three important advantages.

FIRST: it provides consistently higher corrosion resistance for different aluminum alloys treated in the same bath.

SECOND: it provides a more uniform appearance for parts of different alloys and with varied surface finishes before treatment.

THIRD: its operating and technical characteristics are superior to those of other processes.

If you are using or planning to use a chemical finish for aluminum, you should have full details on new Iridite #14-2. Write us or send samples for free test processing. Or, for more immediate advice, call your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book. - - - ALLIED RESEARCH PRODUCTS, INC., 4004-06 EAST MONUMENT STREET, BALTIMORE 5, MARYLAND.

P. S. Even new Iridite #14-2 will be constantly measured against both your needs and competitive processes to make sure you get the best possible, most economical finish for your product that man and the laboratory can develop.

Apparatus for Cleaning Filters

U. S. Patent 2,710,099. *June* 7, 1955. *A. A. Kalinske, assignor to Infilco, Inc.*

In a diatomite filter including a casing having a top, an inlet for the liquid to be filtered, an outlet for the filtered liquid, an inlet conduit discharging into said casing through said inlet, a filter element interposed between said inlet and said outlet, wall means forming an air space in open communication with the liquid upstream of said element, said top forming a second air space in open communication with liquid downstream of said element, a vent from said first air space, and a quick acting valve on said vent: the combination with said inlet conduit of aspirating means for introducing a gas into said inlet conduit and discharging it under liquid inlet pressure into said casing during filtering.

Molten Salt Bath Descaling

U. S. Patent 2,710,271. *June* 7, 1955. *E. B. Fernser and H. E. Tschop, assignors to The International Nickel Co.*

In the process for annealing and cleaning an oxidized metal article made of an alloy used for resistance to heat and to corrosion and characterized by a refractory oxide coating containing predominantly an oxide of a metal having an atomic number from 24 to 29, the improvement which comprises immersing the oxidized article in a salt bath comprising about 20% to 80% sodium fluoride, with the balance essentially sodium carbonate, for at least about two minutes at a temperature of about 1,500° to 2,000°F.

Hot Tinning Oil

U. S. Patent 2,710,272. *June* 7, 1955. *W. O. Cook, assignor to U. S. Steel Corp.*

A tin-pot oil consisting of a major portion of a mineral oil having a flash point greater than 500°F.; at least about 5% by weight of fatty oil selected from the group consisting of palm oil, castor oil, tallow, hydrogenated corn, cottonseed, coconut and fish oil; and at least 0.25% by weight of stannous chloride.

Buffing Stainless Steel

U. S. Patent 2,710,502. *June* 14, 1955. *G. A. Lyon*

A method of treating a wrought stainless steel sheet-like article, that comprises immersing the article in a liquid medium maintained at 1,200-1,300°F. for ½ to 1½ minutes, then removing and quenching and finally buffing a surface of the article to smooth-finish the same.

Surface Tension Meter

U. S. Patent 2,710,539. *June* 14, 1955. *M. Pollack*

A surface tension meter consisting of a flat member, said flat member comprising a handle section and a plurality of linearly disposed successive rings the apertures of which are of varying diameters, said handle section being integrally and linearly secured to said plurality of rings.

Automatic Plating Machine

U. S. Patent 2,710,698. *June* 14, 1955. *P. A. Hauck and G. Todd, assignors to Hanson-Van Winkle-Munning Co.*

In a processing machine, the combination of an elevator structure movable between upper and lower positions, the structure having a member providing a track interrupted by a plurality of openings spaced along the member, a lifter element mounted on the structure at each opening and movable to close its opening, the element being normally in inoperative position, means near the lower position of the structure for moving the elements into operative position on successive upward movements of the

LEA

PROMPT SHIPMENTS

...IN THE MICHIGAN AREA FROM OUR MICHIGAN AFFILIATE

Lea-Michigan, Inc., our Michigan Affiliate, is now well into production on several Lea Finishing Specialties widely used in industry. For example:

Polishing Specialties

LEA LIQUABRADE . . . . . liquid, non-flammable buffing composition, available in a wide range of abrasive types and sizes; especially advantageous in automatic production line finishing

LEA GRIPMASTER . . . . . liquid polishing wheel sizing, containing no abrasive, for bonding medium to coarse grit abrasives on wheels and belts

LEA PLASTI-GLUE . . . . . liquid polishing wheel sizing, containing no abrasive, for bonding finer grit abrasives on wheels and belts

LEABRAMENT . . . . . quick drying, liquid abrasive composition for burring, polishing and satin finishing; formulated *with* medium to heavy cutting grit abrasives

LEA PLASTI-BRADE . . . . . liquid abrasive composition for wheels and belts; formulated with a special flexible binder containing finer grits

DETROIT

Electro-Chemical Specialties

LEA COPPER-GLO . . . . . effective addition agent used only with the LEA-RONAL High Speed Bright Copper Plating Process. Makes it practicable to plate copper on prefinished steel and die-castings and then plate chrome directly without intermediate nickel or buffing. The LEA-RONAL Bright Copper Process is so successful in improving plating and/or lowering costs, we suggest that every plant operating with cyanide copper investigate it

SUPERTARTRAL . . . . . superior addition agent to replace Rochelle Salts applicable to *any* cyanide copper bath, providing smooth deposits and excellent anode corrosion

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Lea-Ronal Bright Copper process

Tolerant to Contaminants

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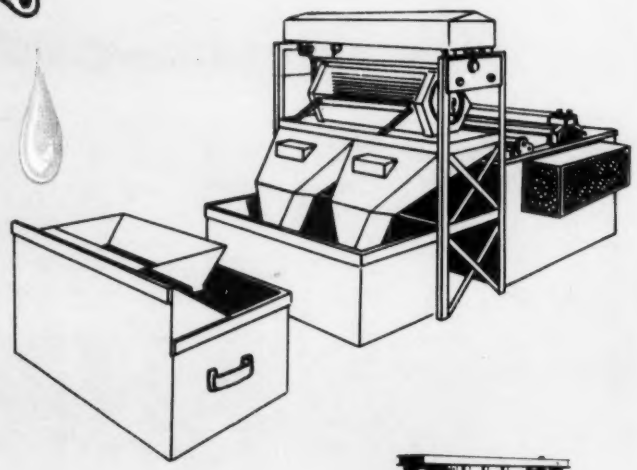
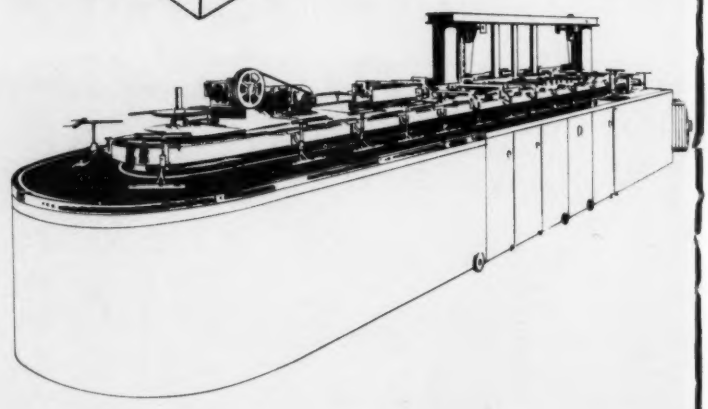
- *Carbonates*





. . . while consistently producing a high speed, buffable, bright plate through the use of Lea Copper-Glo.

The extensive tolerance of the Lea-Ronal Bright Copper Process to contamination has been proved at the many plants using this cyanide copper process. Recommendations available from our engineers and laboratories provide the "aspirins" for conditions which are the "headaches" of conventional cyanide copper plating.

How about your copper plating process? Can the same be said for it? Or is there a constant battle with contamination and constant uncertainty as to uniformity and quality of plate and even as to the length of the plating cycle?

You should investigate the use of Lea Copper-Glo in the Lea-Ronal Bright Copper Process. In all probability your present solution can be converted to this proved superior process. You can be confident that you can obtain this high tolerance to contaminants and the better plating in general that hundreds of plating shops and industrial plants are already enjoying in their cyanide copper plating.

In writing for the newly revised Copper-Glo technical manual, please describe fully your present problems and requirements.

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Manufacturing Plant:
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elevator, said means including a cam member for each element, the cam members being movable to an effective position, where they are engaged by a part of their respective elements and move the latter as the structure moves, and means for moving the cam members to effective position, and means operating on the inoperative elements near the upper position of the structure to move them to close their openings and complete the track.

Pickling Aluminum

U. S. Patent 2,710,792. *June* 14, 1955. *L. McDonald and A. E. Hawley, assignors to Kelite Products, Inc.*

A composition for etching aluminum and aluminum alloys preparatory to spot welding, said composition comprising, phosphoric acid, a sequestering agent, and an aryl sulfonic acid having less than 7 alkyl carbon atoms.

Iron Plating Bath

U. S. Patent 2,710,832. *June* 14, 1955. *R. E. Harr, assignor to Western Electric Co.*

An electroplating bath, which comprises an aqueous acid solution including as a major component ferrous ammonium sulfate and having a small amount of ammonium fluoborate added thereto in concentration sufficient to prevent formation of slimy precipitates.

Selective Plating

U. S. Patent 2,710,834. *June* 14, 1955. *M. Vrilakas*

An apparatus for selective plating comprising a tank for containing a plating bath, a pair of parallel elongated electrodes, means above said tank for suspending said electrodes in said bath for swinging movement on a fixed horizontal axis, a casing of electrically insulating material extending around said electrodes and in freely sliding relationship therewith, said casing being open at the top and bottom and having alined openings therethrough between said electrodes, means for supporting an object to be plated extending through said alined openings and between said electrodes, means for supporting said casing on said object, means for moving said object and said casing in said bath in a direction along the length of said electrodes and in a direction transverse to the length of said electrodes, means for preventing said electrodes

touching said object, and means for including said object and said electrodes in a plating circuit.

Electrodeposition of Antimony

U. S. Patent 2,711,010. *June* 21, 1955. *W. P. Karash, assignor to The Harshaw Chemical Co.*

An article of manufacture comprising a ferrous metal body, an adherent coating of lead overlying said ferrous metal body and an adherent coating of antimony overlying said coating of lead, said coating of antimony having been applied upon an unroughened surface of said lead coating, and said antimony coating being fine grained and adherent and having occluded therein a trace of an aromatic sulfonamide containing a nitrogen atom carrying from 1 to 2 aromatic groups of the structural form RSO_2—, where R repreesnts an aromatic radical containing 6 carbon atoms.

Bright Dip for Zirconium

U. S. Patent 2,711,364. *June* 21, 1955. *J. G. Beach, assignor to the United States of America.*

A process of polishing the surface of zirconium metal containing zirconium carbide occlusions comprising immersing said surface into an aqueous solution of about 60 to 85°F. consisting, per one liter of solution, of water, at least 50 grams of a water-soluble fluoride, 350 to 600 cc. of concentrated nitric acid and from 175 to 400 cc. of a 30% fluosilicic acid.

ABSTRACTS

Bright Plating from the Acid Copper Bath

By Dr. Reuss

The copper sulfate bath has been in use now for over 100 years but one great disadvantage has been that it is only possible to plate on iron or steel if they have been previously nickel plated or given a copper flash in the alkaline bath. The acid copper bath is very easy to control and the soft copper deposit can easily be polished and shaped. Rapid deposition is possible with the modern cyanide copper baths. With the employment of periodic reverse and with the aid of additions agents, the surface obtained can be made smoother and brighter up to a certain degree but, for the higher demands, this does not suffice. Quite often it is thus necessary to polish before the bright nickel plate. Difficulties are also caused with the cyanide waste water disposal.

The author then proceeded to discuss the newly developed bright acid copper bath—the "cupat" process. Rubber-lined steel tanks are used and continuous filtration is applied, which also serves to circulate the solution. It is of advantage, after a short sulfuric acid pickling, to be able to copper plate directly; the bath is characterized by a broad bright plate range, good throwing power and current efficiency and no heating or fume exhausting is necessary. The Hull cell is used to control the bath. Additions to the bath allow of the desired quality being maintained with special plating conditions. With a prior alkaline coppering, die cast zinc parts can also be bright coppered in this bath. The deposit can be very easily buffed and polished. A certain leveling and smoothing effect is also obtained with this bath but the main advantage claimed is the high degree of brightness obtained. The operating temperature should not exceed 30°C. The plating speed is claimed to be very high, and the brightness of the deposit is stated to correspond almost to that of bright nickel. The high throwing power of the bath is another outstanding feature and this is stated to be not greatly inferior to that of an alkaline copper bath, and is completely sufficient for most purposes. The organic addition agents used in this bath are added in extremely small concentration.

Electroless Nickel Plating

By Dr. Bosdorf

The deposit obtained with electroless nickel is pore-free and is characterized by a high hardness. Deposition, even with strongly profiled parts, is completely uniform and the process can, accordingly, find particular application for internal nickeling. The pretreatment of the parts is the same as the pretreatment for normal plating. Chemical reduction of the nickel is conducted in an alkaline or an acid bath. The working temperature of the bath is 90-95°C. The process is based on the strong reducing action of hypophophorous acid. By means of diagrams the relationship was shown of the amount of nickel reduced to the time in the bath and the relationship of the amount of nickel deposited to the nickel content of the bath on the one hand and to the sodium hypophosphite content of the bath on the other hand. Maintenance of the pH value of the bath at a constant value is necessary for conducting the process successfully. A coating thickness of 15-25 microns is obtained within an hour.

As compared with plated nickel deposits, the hardness of the coating, which is about 500 kg./sq. mm. Vickers hardness, can be raised by further treatment. Periodic filtration of the bath is particularly necessary. Regeneration of the bath is also possible. The electropolishing or mechanical polishing characteristics of the deposit are good. A certain leveling and smoothing effect is also achieved with this process. By virtue of the hardness and uniform coating thickness, the application of this process for press tool processing would appear to be of particular technical interest. Mass produced articles can be nickel coated by this process in barrel or drum units.

The bath costs are somewhat high, but this can be supported in those cases where it is not possible to obtain a suitable electrodeposit. This holds good particularly for internal coating and in those cases where hardness of the nickel coating without cracks and internal stresses is desired. Further developments in this process have been toward automatic regeneration; the baths can also be freshened up by special additions.

Topochemical Investigations on Structure of Plated Metals

By Dr. A. Kutzelnigg

The author reported on investigations conducted by topochemical reactions with electroplated coatings and the purpose of these investigations was to obtain information on the structure of the deposit. Mention was first made of the research conducted by E. Raub who found that an electrodeposited metal showed a disturbed crystal lattice under the effect of foreign bodies.

Topochemical (i.e. localized chemical reactions) can be conducted in the following ways:

a) The plated coating is converted into an insoluble reaction product.

b) The plated metal is dissolved away. The non-metallic occlusions then remain behind.

It happens that, with reactions of this type, in many cases colored products are obtained. Silver coatings can, for example, be reacted with iron chloride to produce violet-brown silver chloride coatings. As is known, such colorations are indicative of interference phenomena. The author then gave a detailed presentation of the work of Frenkel and Schootky in this direction.

It is noteworthy that organic additions cause a change of the coloration of these topochemical reaction products. If carbon bisulfide is added to a silver electrolyte, for example, no violet-brown silver chloride coating is obtained with ferric chloride but a slate grey coloration. The color of the coating changes with prolonged storage. Decoloration occurs from the edges inwards and this was explained by a relieving of the original stressed condition. Research was conducted with the second group on electroplated nickel films as well as on chromium films. It was found that, after solution, a transparent skin remained behind.

The stability of a chromium coating is explained by the presence of an oxide film. Cohen has proved the presence of oxide films of this type and isolated them; the author himself

similarly found an oxide skin by dissolving the chromium in 20-50% iron chloride solution. Solution takes place with gas evolution.

The reaction of electroplated nickel films is better suited for the study of the phenomena as, in this case, no gas development occurs and the oxide film is, accordingly, better. The proof that it is a question of a non-metallic skeleton substance and not an oxide film was conducted as follows: a nickel film which had been deposited in a Hull cell was treated with iron chloride. If it was a question of an oxide film, then the thickness of this would be independent of the thickness of the metal film. If, however, it is a question of a skeleton substance grown in the plated metal film, then the thickness of the film which remains behind after the metal has been dissolved away must increase in accordance with any increase in the thickness of the plated metal film. This was in actual fact observed. It is however possible in spite of this that, in addition to this substance, an oxide film is present as well.

Problems with the Plating of Aluminum and Aluminum Alloys

By Dr. Wullhorst

Either acid or alkaline solutions can be used for opening up the metal surface. Apart from those plating processes, which use an oxide as the basis for the coating adhesion, it is essential that the pre-pickling solution used should dissolve away the natural oxide film, without attacking the aluminum metal too sharply, which would result in roughness of the subsequently applied deposit.

For the pickling baths, suitable agents are caustic soda, hydrofluoric acid and salts of this acid, and also hydrochloric acid. By cementing-out a metallic coating, protection against the reformation of an oxide skin and the basis for a subsequent plating stage is achieved. The author then discussed in detail the use of zincate baths with and without copper addition, zinc-contact baths with hydrofluoric acid and fluorides, and the hydrochloric acid baths and their field of application, particularly as regards the treatment of the various aluminum alloys. A suitable basis is obtained by the oxidation process in phosphoric acid baths of various concentrations. The requirements for good adhesion of a deposit on aluminum are not a roughening of the surface but exposure of the chemically clean surface.

For the practical use of the deposit, behavior against possible corrosion influences is of importance. The coatings which are in direct contact with the base material can be of significant importance in this connection. The attack is stronger on the nobler and more porous deposits. As has been confirmed by investigation results in a series of cases, aluminum, at least temporarily, can behave nobler than zinc, iron and chromium, while nickel is always nobler than aluminum.

If hard chromed parts are subjected to elevated temperatures, there exists the danger of inter-crystalline corrosion through reaction of the intermediate zinc coating with the aluminum; this can also occur with porous copper and nickel coatings. The intermediate zinc coating should be maintained as thin as possible and care should be taken that more compact and pore-free plated deposits are applied. The author then dealt in detail with the application of plating on aluminum and aluminum alloys for decorative nickel and chromium, hard chromium and subsequent soldering. Although it is possible today, to produce coatings on pure aluminum and low alloy aluminum by chemical or anodic polishing, and subsequent anodizing which, as regards appearance, corrosion resistance, hardness, and wear, are equal to or even superior to plated coatings, plating of aluminum has a broad field of application. A survey was given of the practical difficulties in aluminum plating.

A specialized problem is the plating of aluminum for soldering. Up to now, some difficulties have been encountered in this connection. Several processes are now available which give good results. Here, the use of an intermediate zinc coating is unfavorable because the danger of intercrystalline corrosion occurs. On the other hand, intermediate nickel coatings and the use of a cadmium solder have been found to give the best results. An intermediate iron coating on the aluminum for soldering purposes was also tested, pure aluminum being used with the application of a cadmium-zinc solder.

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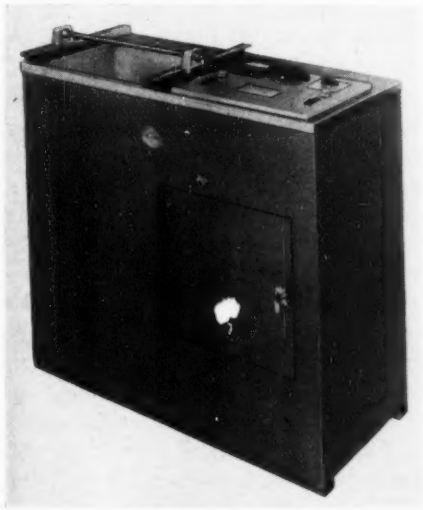
Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT
FOR THE METAL FINISHING INDUSTRIES

Portable Plating Unit

Bart-Messing Corp., Dept. MF, 229 Main St., Belleville 9, N. J.



Incorporating the features and automatic equipment usually found in large, mass production plating installations, the new Sel-Rex Jet Plater, is said to be a complete electroplating plant in a compact, portable unit.

Fully automatic in operation, the plater consists of a Sel-Rex selenium rectifier with automatic timer, stainless steel tank (which may serve as the anode) fitted with a water jacket for temperature control; a movable work rack which will accommodate a portable plating barrel; a centralized control panel equipped with Weston ammeter and powerstat control; a filter; and a drip-proof pump with motor.

Agitation is accomplished through a pump and perforated stainless steel tube at the bottom of the plating tank. The resultant constant motion of the solution around the work, the manufacturer states, assures consistently smooth, even deposits, and high quality plating.

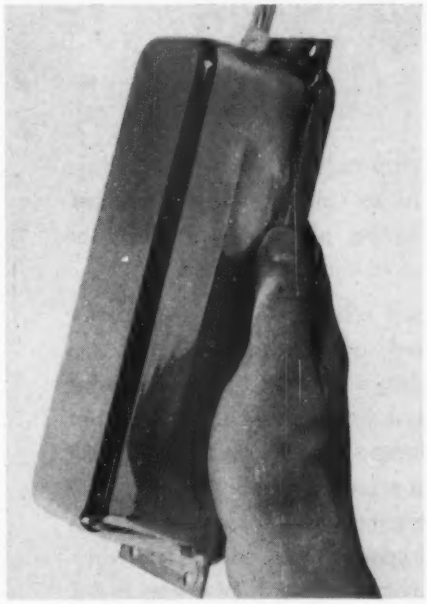
Standard models require only approximately 18" x 38" of floor space, and are available in 10, 20 and 30 gallon capacities. All models can be used for still or barrel plating of any precious metal solution, small volume acid or alkaline solutions, conventional or bright.

Ultrasonic Cleaning Equipment

Branson Ultrasonic Co., Dept. MF, 194 Richmond Hill Ave., Stamford, Conn.

Hermetically sealed ultrasonic power transducers and improved generators operating at 40 kc./sec. have been announced by the above manufacturer. Sharply reduced cost and versatile design of the transducer makes it possible to apply ultrasonic energy to many applications which had previously been considered impractical or economically unfeasible.

The large, uniform radiating surface of the transducers makes them particularly suitable for ultrasonic metal cleaning applications, such as



removal of buffing compounds, soldering flux, carbon smut, etc. The transducers can also be used for other processes in liquids which benefit from ultrasonic energy, such as plating, pickling and descaling.

The standard LF-15 transducer has a radiating area of 2⅝" x 6". The modular transducer design facilitates a wide choice of arrangements, including flush transducer banks, focussing and diverging. Ultrasonic energy of the proper intensity can be applied as required by the shape of the part.

Solvent Cleaner

Park Chemical Co., Dept. MF, 8074 Military Ave., Detroit 4, Mich.

New Parko Super Solvent parts cleaner is guaranteed to have no corrosive effect in metal parts.

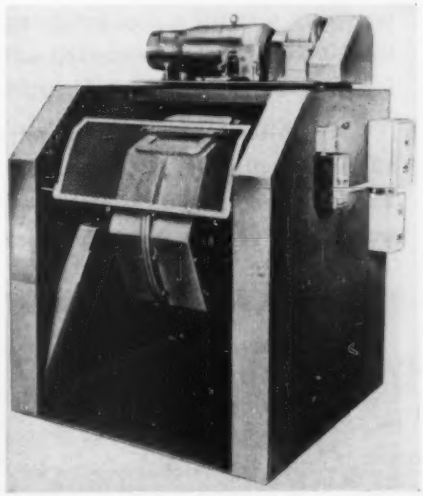
According to the above manufacturer, it is only necessary to soak the parts for a short time, rinse them in clear water or petroleum spirits and reassemble. It is used cold, in an open container because it evaporates even more slowly than water, and without odors.

Said to be extremely fast acting, non-corrosive and long lived even in open containers, the cleaner is supplied in gallon cans and in 3 and 5 gallon drums with self-contained dipping baskets.

Triple Action Cutting Barrel

The Hartford Steel Ball Co., Inc., Dept. MF, 12 Jefferson Ave., West Hartford 6, Conn.

The above manufacturer has introduced into their line of famous triple action cutting barrels two new fully enclosed models with 10 and 4 cu. ft. capacities. These new models with their unique barrel design are claimed to provide more action, faster action and more uniformity in a wide range of finishing operations. They speed

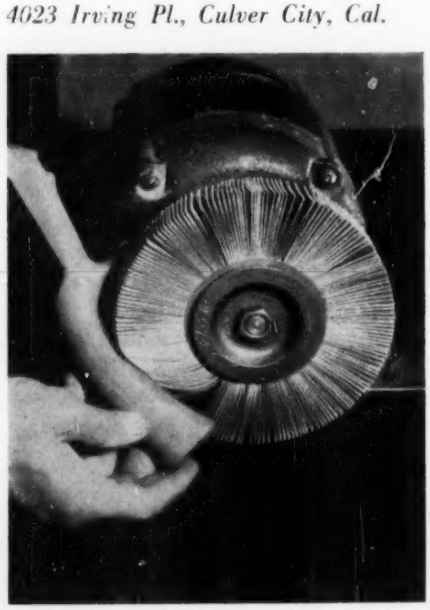


debu.ring, descaling and polishing on screw machine parts, stampings, castings. Parts can be quickly and economically processed by any tumbling method, abrasive chip process, ball and steel shape process, bi anded compound or other medium for special jobs, it is claimed.

The power unit is on top for long life, cleanliness and ease of maintenance. This feature also permits extremely compact design. Other labor and time-saving features include greater accessibility of controls which are grouped together; drum type reversing switch; 24 hour program timer that can be set for any cycle from 15 minutes to 24 hours with completely automatic control; magnetic starter and brake which permit inching of barrel into loading and unloading positions, tilt-back front safety guard; and improved 4 speed gear shift control, permitting standard R P.M. barrel speeds of 8-11-18 and 33 on 10 cu. ft. model and slightly higher proportionate speeds on 4 cu. ft. model. Other speed ranges can be supplied. Optional features include single speed or fully variable speed drives; special hollow shaft with rotary pressure joint that permits permanent water connections for faster filling and flushing of barrel. These models can also be supplied with Neoprene lined barrels. As a safety feature barrels have pressure vent in cover.

Gritted Cloth Wheel in New Large Sizes

Merit Products, Inc., Dept. MF, 4023 Irving Pl., Culver City, Cal.

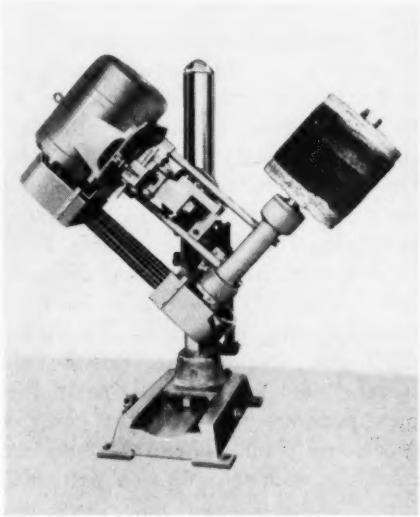


The Grind-O-Flex Wheels, formerly available only in six inch diameters, are now made in 10" and 12" di-

ameters for mounting on buffing lathes and heavier polishing and deburring operations. In the coarse grit grades, the wheel is capable of fairly heavy flash removal operations; in the fine grits, it polishes contoured pieces to a plating finish. The grit is embedded in the cloth. The wheel never needs regritting and the "scratch" is absolutely uniform for the entire life of this long-lasting wheel.

Wide Face Polisher

Murray-Way Corp., Dept. MF, Box 180, Birmingham, Mich.



Known as the No. 53, this new wide-face polisher with built in floating action will handle widths up to 24". The floating action gives an even buffing and polishing on the entire surface. It simplifies the positioning of the work piece and, once the proper pressure is established, hundreds of pieces can be uniformly processed.

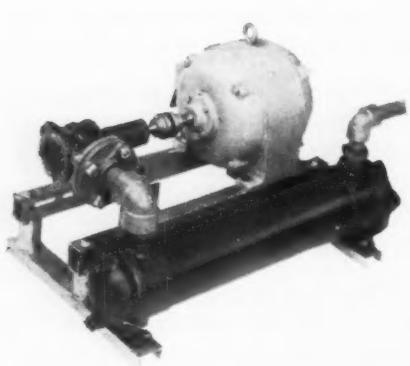
The polisher is stated to cut down the number of heads necessary to process work pieces, greatly reduce the number of passes needed to polish the work piece and give the ultimate in positioning flexibility.

This new wide face polishing wheel is available in two models. The No. 53 Heavy-duty and the No. 54 which is ¼ smaller in size than the No. 53.

Stainless Steel Heat Exchanger

Process Engineering Co., Dept. MF, 6435 North Central Ave., Chicago 30, Ill.

The Prenco stainless steel heat exchanger is an integral pump, motor and heat exchanger unit designed to handle heat transfer requirements involving corrosive liquids in the elec-



troplating or chemical processing industries.

Both the circulating pump and heat exchanger are made of Type 316 stainless steel. The pump is a self-priming positive displacement paddle type having a Neoprene impeller. It is driven by a totally enclosed 3 phase 220/440 volt ball-bearing motor. Pump, motor and heat exchanger are mounted on a structural framework to give a neat and compact unit. The standard heat exchanger occupies a floor area of about 29″ x 22″ and stands about 18″ high. All that is necessary to put it into operation is to make the proper plumbing and electrical connections.

The heat exchangers are available in alloys other than stainless steel where corrosion requirements necessitate such alloys, as well as some of the more simple alloys where corrosion is not a particular problem.

Chromium Diffusion Coating

Alloy Surfaces Co., Dept. MF, 1115 N. 38th St., Philadelphia 4, Pa.

Inexpensive laboratory test kits, containing the instructions and the materials (except the furnace) required to diffuse chromium into small pieces of ordinary steel and give them the surface characteristics of stainless steel are being offered by the above company. The kits will enable firms to determine how chromium diffusion can be used economically in their manufacturing operations. Two types of license arrangements can be obtained, one for original equipment manufacturers and one for contract processing plants. Three processes are available, each tailored to a particular range of steel, and laboratory test kits are offered on any one or all of these processes. They are identified as Kromko for low-carbon steel from AISI 1008 to 1025; Metfuse for medium-carbon steel from AISI 1030 to 1050 and alloyed medium carbon steel having a similar range of carbon content; Ardlast for high-carbon steel from AISI 1055 to 1095 and for tool steels, except high speed. The same operating procedures used with the kits are used in actual production.

Packaged Boiler Line

Eclipse Fuel Engineering Co., Dept. MF, Rockford, Ill.

The new Red Band line of Scotch type steamboilerplants ranges from 12 to 125 hp. for gas or oil firing, or combined fuels, for every process heating requirement. All the necessary valves, controls and boiler trim are mounted and internal piping and wiring is completed. When electricity, steam, water and fuel lines are hooked up the boiler is ready to produce steam. Burner equipment is controlled automatically by steam pressure with minimum supervision by the operator.

All design details of the boilers have been worked out to provide hot, dry steam fast, at peak efficiency with long boiler life. The large steam space

in the new boilers combined with larger water storage gives a greater reserve capacity which eliminates fluctuations in steam pressure and meets peak loads quickly and easily. Another important feature is the larger internal furnace with 300 per cent greater combustion volume to permit high heat output without strain or danger of heat cracks. The boilers are claimed to have more heat transfer surface than most packaged boilers to produce rated horsepower quickly and efficiently under normal operating conditions. Maximum heat conduction and convection is provided by 2 in. diameter tubes. The boiler is designed to last a lifetime without costly maintenance.

Corrosion Preventive Paper

Daubert Chemical Co., Dept. MF, 333 N. Michigan Ave., Chicago 1, Ill.

Development of a heat sealable VCI (volatile corrosion inhibitor) treated packaging paper has been disclosed by the above firm.

The new product, designated No. 70 Grade, augments a series of grades of vapor wrapper now used by industry and the military for the packaging of spare parts, tools, and machines.

Air Operated Vacuum Cleaner

J. P. Glasby Mfg. Co., Dept. MF, Belleville 9, N. J.

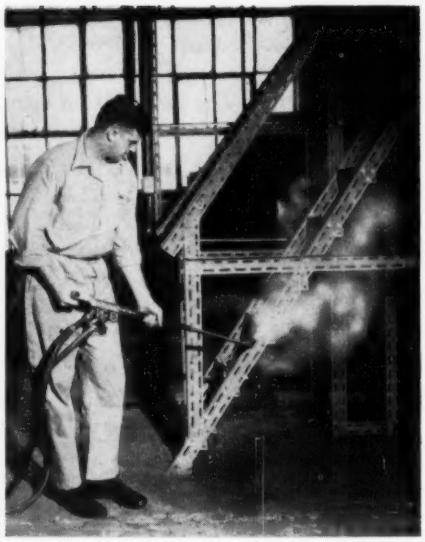
Vac-U-Max is a new, powerful suction, modern industrial vacuum cleaner that operates by use of compressed air only. Based on a simple aerodynamic principle, compressed air, passed through a jet-venturi, creates a very high vacuum.

The unit connected to existing compressed air line, is claimed to develop more than two times the suction of a standard one h.p. electric unit that is equivalent in size. The cleaner has no electrical connections, no motor, no bearings or moving parts, therefore, requires no maintenance. Being non-electric, there is no explosion hazard or other electrical danger. It uses only 25 cubic feet of free air per minute.

Sturdy, light weight, of all steel construction, and readily portable on free-moving rubber wheels, its capacity is 20 gallons. Over-all size is 33″ high and 24″ diameter.

It is stated to offer the most efficient means of collecting and handling either disposable or reusable waste. It may be used for either dry or wet

pickup. In either application, the solid waste is collected in a reusable burlap bag within the container. For wet pickup, the fluid is drained from the bottom of the unit through a drain cock provided.



Steam Cleaning Gun

Oakite Products, Inc., Dept. MF, 19 Rector St., New York 6, N. Y.

The Hurriclean Gun, designed for steam cleaning efficiency, cool handling, and easy operation, has recently been introduced by the above manufacturers.

The most revolutionary feature of this new solution-lifting steam gun is the ingenious way in which the cleaning solution is used to protect the operator from the heat of the steam. Where other similar steam cleaning devices have had separate tubes for solution and steam, the new gun uses a tube within a tube—steam passing through the insulated interior tube, solution through the exterior. The steam loses none of its heat, but the cleaning solution reduces the external temperature of the gun. The solution is automatically drawn into the nozzle of the gun by the partial vacuum created by the steam passing through.

Another feature of the new gun is the sealed rotary joint which makes it possible to rotate the nozzle without twisting or wrestling with heavy solution or steam hose. While the forward end of the gun revolves to clean at any desired angle, the handle and hose connections remain stationary. Operator fatigue is further reduced by designing the gun so the thrust of the steam is taken up between the handles.

The gun is precision made, with a cast aluminum spade-type rear handle, cast brass valves, stainless steel outer and inner tubes and nozzle, and an oil-resistant forward rubber grip. It weighs 6¾ pounds in its 3½ foot length, and slightly more in the 5 foot size. Maintenance is simple, there are no moving parts except the brass valves and the sealed rotary joint. Because solution goes through the tube at a comparatively low temperature, there is little danger of clogging or scaling up. The nozzle is protected from rough treatment by an added stainless steel tip.

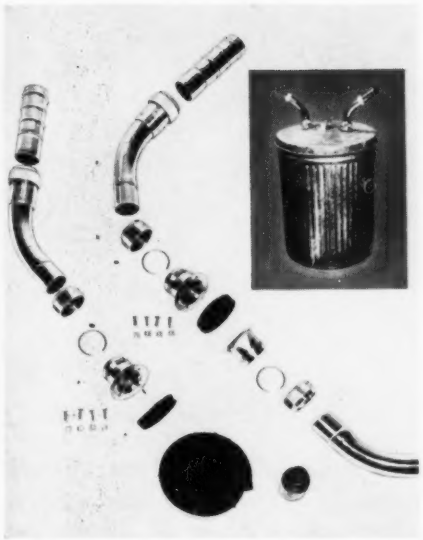
No elaborate equipment is needed. The gun needs only steam and solution hose, cleaning solution made up in a 50-gallon drum or other container, and 30 pounds of steam. To operate, it is merely necessary to hook up the hoses, mix the solution, put one end of the solution line in the container, adjust steam and solution valves, and clean. Rinsing is accomplished by shutting off the solution valve and using steam alone.

Auxiliary Vacuum Cleaning Tank Kit

Premier Company, Dept. MF, 755 Woodlawn Ave., St. Paul 1, Minn.

An auxiliary tank kit has been designed to provide additional wet or dry tank capacity for heavy volume vacuum cleaning work. The kit includes all attachments necessary to convert a standard 30 gallon waste can into an auxiliary tank. This tank is connected ahead of the vacuum machine.

Included in the kit is a hose adapter, swivel attachment nut and ring, curved



tube, curved swivel tube, gaskets, bolts and nuts.

The new kit allows the cleaning of an area that formerly was considered hazardous because of volatile conditions. The vacuum unit, with separately ventilated motor, is left in a "safe" area while the operator, using the auxiliary tank, works in the danger area. The unit is easily interchangeable with two or more cans and operates with any commercial vacuum cleaner.

Easily Applied Plater's Putty

Anderson's Plastics Co., Dept. MF, Natick, Mass.

Platers Putty formula L is a stop-off in the form of a heavy bodied oil which is resistant to acids and alkalis and is applied by dipping or by camels hair brush. The surface of the putty can be set or dried by immersion in hot water or other means of heat (200° to 250°F.) for a few minutes.

It is claimed that the material will not dry out or harden even if left in open. It can be used as described above or, if a more permanent cap or rack coating is desired, the heat must be increased to 300 to 350°F. for 15 to 20 minutes. Surplus putty can be cleaned off with naphtha.

Trial pound packages are available at $2.50/lb. postpaid, 10 lbs. at $2.00/lb. pp., 50 lbs. and over at $1.10 f.o.b. Natick.

Batch Washer for Small Parts

The Alvey-Ferguson Co., Dept. MF, Disney St., Cincinnati 9, O.

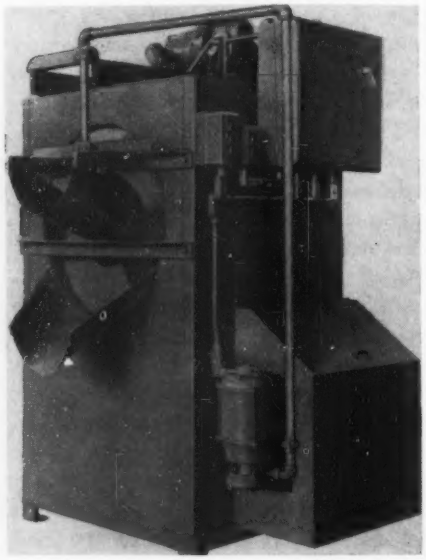
Small parts can now be high-pressure spray-washed economically in bulk by means of a new small rotary-drum batch-type machine recently perfected.

Parts batches are introduced into the machine through the upper chute. The new one-man-operated machine utilizes a drum with helical spiral to tumble parts gently and expose all surfaces thoroughly to the high-pressure fan-shaped spray nozzles inside the drum. The drum, perforated to permit draining of the solution, oil, chips and impurities, retains only the clean, thoroughly-washed parts. On completion of the cleaning cycle, the drum counter-revolves, automatically discharging the clean parts into a tote box or other suitable container by means of the lower chute.

Location of both chutes on the same side of the machine minimizes space requirements and permits installation directly against other machinery, walls or supporting structures.

The washing, pumping, drum-reversing cycle can be either manual or automatic. If the installation is automatic, an adjustable timer is provided. Complete draining and quick flash-dry for all parts is accomplished through tumbling with pump off as parts are discharged.

Drums can be made for any given batch capacity; a volume of two cubic feet has been found ample for most operations. Cleaning solutions may be heated by steam, gas or electricity. The washer features heavy welded construction, easy accessibility to all

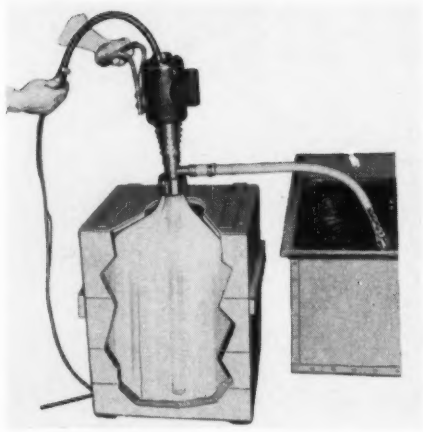


parts, high-pressure cleaning with fan-shaped spray nozzles and high quality filter screens. High production (up to 20 cu. ft. per hour) becomes especially significant in view of the small space requirement, low maintenance and low initial cost of this new small parts batch washer.

Acid Pump

Thompson Mfg. Co., Inc., Dept. MF, Erie, Pa.

The new, portable Centri-F Acid pump was primarily designed to transfer acids from small, open, plating, finishing, and storage tanks, but the size of the intake pipe is such that it may also be very easily inserted into



the openings of standard carboys and drums.

The pump is driven by a totally enclosed motor, and delivers a smooth, spurt-free flow of approximately six gallons per minute.

The pump is constructed of the most corrosion-resistant metals and plastics available, and may be used with almost all of the commonly used industrial acids.

Water-Soluble Burring Compound

Harrison & Co., Inc., Dept. MF, 487 Groveland St., Haverhill, Mass.

Developed to adhere to sisal, tampico or cloth but still water soluble for easy removal. D-54 is recommended for burr removal and fast cutting on steel, stainless steel and miscellaneous ferrous and non-ferrous metals. Soaking in hot water will soften sufficiently to remove most deposits but power sprays or regular cleaners are recommended for short cycle cleaning especially on internal surfaces with high build up. Product is clean working and fast cutting with an excellent surface finish.

Spray Cleaner Compound

Wyandotte Chemicals Corp., J. B. Ford Div., Dept. MF, Wyandotte, Mich.

Expray (AP) — all purpose, has been found to be effective for spray cleaning from 70°F. to 200°F., according to the above manufacturer. It contains a rust inhibitor to protect cast iron and steel between manufacturing operations. Users find that it gives good detergency in all waters at all temperatures, and cuts maintenance costs in washers with the elimination of clogging and scaling, it is claimed.

This new product for spray washing is unique in composition and permits the safe use of one product on most metals and glass. Results with this new product have proved dependable even in cold cleaning operations. The product is mild, easy to handle, non-dusty, non-scaling and may be used at high concentrations in high pressure washers without causing foaming troubles.

Tungsten Carbide Coatings for Buffing Fixtures

Fusion Metal Coating Co., Inc., Dept. MF, 25493 W. Eight Mile Road, Detroit 19, Mich.

The above manufacturer announces the availability of Fusecoat "T," a tungsten carbide fusion bonded to the base metal of all kinds of buffing fixtures, screw heads for holding fixtures, rails for straight line polishing, headless nails for cleaning buffs, jaws, clamps, etc. Wear resisting carbide coating is bonded to the base metal by an alloy binder. The coating thickness is from .005" to .025" but can be as much as .05" by applying several layers.

The customer indicates by markings on sample pieces or on drawings or blueprints where the coating is desired. It can be applied inside or outside, or to all the surface or only to certain portions. The coating can be placed around sharp edges or in deep grooves and adjacent to tapped holes without damaging the threads. The first buffing fixtures coated with Fusecoat "T" are said to have broken all records for length of service before replacement, and some have lasted for a full production run.

The advent of Fusecoat "T" makes it no longer necessary to have buffing and polishing fixtures of heavy iron or steel. It also replaces chromium plated or nitrided surfaces and makes it unnecessary to build up hard alloys by welding process followed by touch-up grinding.

For information and advice about wear patterns, write direct to the manufacturer. The process is patented.

Tarnish and Spotting Out Preventer

The Chemical Corporation, Dept. MF, Springfield, Mass.

Luster-On NS is claimed by the above manufacturer to be the answer to "spotting out" troubles on thin copper and brass plate, especially under humid conditions. It is also suggested where porous castings are difficult to rinse, and is stated to prevent tarnishing and eliminate finger printing in assembly operations. Also to improve adhesion, provide leveling action, save lacquer.

NEW BOOKS

Handbook of Barrel Finishing

By Ralph F. Enyedy. Published by Reinhold Pub. Corp., 430 Park Ave., New York 22, N. Y. 1955. Price: $7.50. 255 pages.

Barrel finishing has made great strides during the last decade or so but the accumulated information, especially with regard to barrel sizes and types, speeds of rotation, and ratios of parts to media, has been so specific that generalities and fundamentals could only be employed as a starting point for further experimentation.

In this book, the first to be published on the subject, the author effectively overcomes this hurdle by reproducing over 150 complete specification sheets for finishing a large variety of parts. The final result is that the reader, by thumbing through the pages, stands a good chance of finding a part and finish described quite close to the one in which he is interested. However, it must be pointed out that the reader will still find it necessary to obtain the assistance

of suppliers for the proper use of their compounds.

After short but adequate descriptions of equipment and media, the author lets the case-histories speak for themselves in sections devoted to the different types of finishes produced by tumbling. The book concludes with a section on interesting applications of the technique.

Chemical Engineering Catalog

Published by Reinhold Pub. Corp., 430 Park Ave., New York 22, N. Y. 1955. 1,917 pages.

The fortieth annual edition, which is available to users of engineering materials and equipment, lists the products of more than 550 manufacturers. The catalog is indexed by company name, functions, equipment and materials of construction, specialized services, trade names, and includes a special index listing manufacturers who are prepared to turn out small scale pilot plant equipment. The user can, therefore, start his search for a particular product, in any of these ways.

The weighty book has maintained its reputation of including the latest advances in the chemical process industries and continues to serve as the leading source for information on chemical engineering products and services.

ASTM Standards: Part 1

Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 1955. 1,834 pages. Price: $13.50.

Part 1 — Ferrous Metals, containing 1,834 pages and 315 standards, is 11 per cent larger than the 1952 edition and contains 125 standards that are new or have been revised since the 1954 Supplement was published a year ago. Since 1952, 211 standards are new or have been revised.

Part 1 contains standard and tentative specifications, methods of test, and definitions for steel materials; corrosion-resisting steel, and metallic coatings for steels; as well as general methods of testing. Materials engineers, purchasing agents and others concerned will need the new Part 1 to enable them to be sure of using the latest applicable standards.

The remaining parts of the 1955 Book of ASTM Standards will be pub-

lished by the Society as rapidly as the editorial and press work can be completed, with the last part expected off the presses about February 1956.

The ASTM Book of Standards is an excellent example of the valuable results which come from the Society's technical committees, bringing together the viewpoints of producer, consumer, and the representatives of general interest in developing competent, unbiased and widely-applicable standards for the manufacture, purchase, delivery, and acceptance of materials.

BUSINESS ITEMS

L. H. Clark Named V.-P. of Pennsalt Chemicals

Lee H. Clark, general manager of the *Pennsylvania Salt Mfg. Co.'s Sharples Chemicals Division*, has been named vice-president of the parent company. While the scope of Mr. Clark's new office was not disclosed, it is understood that his major duties will be concerned with corporate organization and planning functions. He assumes his new position December 1.

Mr. Clark, a native of Brooklyn, is an alumnus of Cornell University where he majored in chemical engineering. Following brief associations with the National Sugar Refining and General Chemical Co., he joined Sharples as a chemist in 1921 and two years later became chief chemist. He continued in this position until 1929 when he joined Sharples Chemicals, Inc. and became manager of its Belle, W. Va. plant and vice-president in charge of production. This plant and Mr. Clark's headquarters were subsequently moved to Wyandotte, Mich. In 1950 he was transferred to Philadelphia, advanced to the office of executive vice-president and served in this position until elected president of the Sharples Chemicals organization in 1954. When this Pennsalt subsidiary was dissolved early this year and integrated as a major operating division of the consolidated company, Mr. Clark continued to direct its activities in the capacity of general manager. He has also been serving as president of the Index Chemical Co., another subsidiary.

Mr. Clark's memberships include the American Chemical Society, American

Institute of Chemical Engineering, Sigma Xi and Tau Beta Phi honorary societies, the Midday Club of Philadelphia, the Cornell Clubs of Philadelphia and New York City and Merion Golf and Grosse Ile (Michigan) Country Clubs.

Free Course in Electroplating

The course of study in electroplating given at the Fort Greene Evening High School. 29 Fort Greene Place, Brooklyn, N. Y., (formerly Brooklyn Evening Technical High School) will begin its spring term on February 1, 1956.

The session is divided into classroom discussion and laboratory experiments. The classroom topics will include simple calculations, reading graphs, chemistry of the plating tank, pH, wetting agents, pitting, deionizing. The laboratory experiments will include solution analysis, Hull cell studies, anodizing.

Registration begins January 25, 1956, and daily thereafter from 7:00 to 9:00 P.M. Classes will meet on Tuesdays and Thursdays from 6:45 to 8:15 P.M. including about six (6) Fridays. The term begins February 1 and ends June 30, 1956. Register with *Mr. L. Serota* in Room BW17 or 3E10.

Hartford Steel Ball Appoints New Assist. General Sales Mgr.

The Hartford Steel Ball Co. has announced the appointment of *Emmett N. Shutts* to assistant general sales manager. For the past five years, Mr. Shutts has been the New England sales representative and, prior to his association with Hartford Steel Ball, he was a salesman for Connecticut Light and Power Co. in Waterbury and sales representative and personnel manager for Brock-Hall Co. in New Haven, Conn. A native of Waterbury and a graduate of the Waterbury High School, he now resides in Chesire with his wife and three children. As assistant to *Tom Abbott*, general sales manager, Mr. Shutts will spend much time in the field contacting the company's sales offices throughout the country.

Emmett N. Shutts

Allied Research Expands Facilities

Allied Research Products, Inc., Baltimore manufacturer of chromate conversion finishes and process chemicals, has just completed a plant expansion that doubles the area available for research and development facilities. The new quarters consist of an addition to the structure located at 4004 E. Monument St., Baltimore, Md.

The entire first floor of the new wing is devoted to research and development facilities. In addition to providing approximately twice the area available in the old building, allowance has been made for approximately a 50% future expansion. The second floor is devoted to administrative, sales and general office personnel.

International Rustproof Appoints Butts

H. H. Butts has been appointed sales engineer in the Chicago area for the *International Rustproof Corp.* The

H. H. Butts

announcement was made by *W. N. Murton*, vice-president of the firm. manufacturers of rust preventives and corrosion solvents.

Jones Director of Mfg. at Consolidated Vacuum

Appointment has been announced of *Howard C. Jones* as director of manufacturing, *Consolidated Vacuum Division, Consolidated Electrodynamics Corp.*

In his new position, Jones will direct all manufacturing phases of the firm's line of high-vacuum equipment. He will also direct traffic, purchasing, quality control, and plant engineering operations.

Holder of an M.E. degree from Cornell University, Jones joined the North East Electric Co., Rochester, in 1921 as an equipment engineer. He became plant engineer, chief engineer, and works manager for the firm's successor, Delco Appliance Division, General Motors Corp. He was works manager the past eight years.

He is a member of the Society of Automotive Engineers.

Dr. Lambertson Joins Carborundum

Dr. Wingate A. Lambertson, formerly assistant director and professor of silicate chemistry of the Institute of Silicate Research for the University of Toledo, has been appointed assistant to the manager, Research Branch of the Research and Development Division of *The Carborundum Company*.

Dr. Lambertson, with a broad background in the field of refractories, high temperature chemistry, and ceramic materials for nuclear reactors, will be responsible to expedite the flow of information on the firm's laboratory developments to potential customers with emphasis on military and atomic energy applications of ceramic materials.

A native of Rich Square, N. C., Dr. Lambertson attended N. C. State College and received his bachelor's degree in ceramic engineering in 1941. In the Navy for 3½ years as officer-in-charge of a Naval air mobile training unit, he achieved the rank of Lieutenant. He carried out research on Navy boiler refractories for three years at Rutgers University, New Brunswick, N. J. where he received his M.S. and Ph.D. degrees in ceramics.

Author of many technical articles and active in professional groups, Dr. Lambertson is a member of honorary societies: Keramos, Phi Kappa Phi, and Sigma Xi; and the technical societies: American Ceramic Society and American Chemical Society.

Infilco, Inc., Organizes New Division

The organization of an entire new division, the *Ion-Exchange Division*, has been completed by *Infilco, Inc.*, manufacturer of equipment for all types of water and waste treatment.

The new division will be under the supervision of *Howard W. Frazer*, a graduate of Iowa State in chemical engineering, who joined the firm in 1936. He has been a leading field engineer for the company since 1949,

specializing in ion-exchange treatment. His experience includes close association with many of the largest ion-exchange treatment plants in states bordering the Great Lakes.

Heizmann and Amis New Sales Engineers for Frederic B. Stevens

John R. Heizmann has been appointed as metal finishing sales engineer covering sections of the Detroit area for *Frederic B. Stevens, Inc.*, Detroit 16, Mich.

For the past five years he has owned and operated his own electroplating job shop in Reading, Pa. which gives him an insight concerning the problems of local job shop operators.

John R. Heizmann

Prior to 1951, Heizmann was employed for 12 years as an industrial engineer and member of the executive committee by the Penn Hardware Co., Reading, Pa. His experience with the latter firm included several years as

Robert James Amis

supervisor of metal finishing operations. Three years were spent as an A.A.F. base metallurgist during World War II. Heizmann is a 1937 graduate of the University of Detroit and holds a B.S. in chemistry.

Robert James Amis has been appointed as a metal finishing sales engineer to cover the territory of the eastern section of Detroit and eastern Michigan as far north as Port Huron. Prior to his being named sales engineer, Amis had served the firm in the capacity of chief draftsman and service engineer in the Metal Finishing Division.

Before joining Stevens two and a half years ago, Amis was with A. V. Roe and Co., Ltd., Malton, Ontario, in plant engineering. He also worked on machine design and engineering with Canada's Dominion Rubber Co., Ltd.

During World War II Amis served as a wireless operator and navigator with the R.C.A.F. Coastal Command.

In addition to in-service courses at the University of British Columbia, Amis also graduated with a major in machine design from the post war special Rehabilitation School in Windsor, Ontario, one of several special schools established to ease veteran over-crowding in Canadian universities.

Amis is at present a member of the Detroit Branch, A.E.S.

Seiler Supervisor of Dow Solvent Field Service

In a move to keep pace with increasing markets for chlorinated solvents, *The Dow Chemical Co.*, a major producer in the field, has announced

Wallace U. Seiler

expansion of its customer service program and the appointment of *Wallace U. Seiler* as supervisor of solvent field service.

Seiler, who has been advanced to the newly created post from the company's Technical Service and Development staff, will coordinate the activities of service men with the various sales offices who assist customers in the proper use of chlorinated solvents.

With the firm since 1937 when he was graduated from Purdue University with a B.S. in chemical engineering, Seiler has spent most of his career with the company specializing in chlorinated solvent applications as used in dry cleaning and industry. He has been engaged in this specialty with Technical Service and Development since 1949.

David Day Joins Wyandotte Chemicals

David H. Day recently joined the industrial sales staff of *Wyandotte Chemicals Corp.* He will headquarter in Albany, N. Y. and will be attached to the Buffalo office.

Mr. Day studied metallurgy at U.C.L.A., served in the U. S. Marine Corps for 2 years and did sales and service work for 3 years for electroplating firms in California. For the past 4 years, he has worked for General Electric at Schenectady. He is a member of the A.E.S.

Following intensive product instruction in the firm's chemicals' research and technical service laboratories, Mr. Day received several weeks of application training in a number of metal industries plants in the midwest.

David H. Day

Bergquist to Represent Metalwash

Metalwash Machinery Corp., of Elizabeth, N. J., manufacturer of metal parts processing machinery, announces the appointment of *Kenneth H. Bergquist* to represent the company in Northern Illinois and Southern Wisconsin.

Mr. Bergquist, a graduate of the University of Wisconsin, took his degree in chemistry with additional

Harold J. Coleman

In his new position, Mr. Coleman will directly supervise sales and sales planning for the company's motor generators.

Michigan Abrasive Announces Changes

C. H. (Fid) Wills has stepped into a newly-created vice-presidency and *W. S. (Red)* Hoskin has become the new general sales manager of *Michigan Abrasive Co.*, 11900 E. 8-Mile Rd., Detroit, Mich.

Wills, after completing a highly successful period as vice-president in charge of sales, was the natural one to turn to when the board approved a long-term concentrated program for developing new products and new adaptations for present products.

Hoskin, who has been in the abrasive field since 1934 and has been the firm's leading sales representative for

Kenneth H. Bergquist

courses in engineering. With Metalwash in the engineering department since 1947, Mr. Bergquist was originally employed by the National Lock Co. as plating chemist.

The Chicago Office, now under the direction of Mr. Bergquist, has been relocated to Barrington, Ill.

Chandeysson Appoints New Sales Manager

The appointment of *Harold J. Coleman* as sales manager has been announced by *Chandeysson Electric Co.* Before joining the firm, Mr. Coleman was associated with the General Electric Co. More recently, however, he was a district manager for Essex Wire Corp.

C. H. Wills

W. S. Hoskin

years, was the natural choice to take over as general sales manager in charge of all sales.

Morgan Burt, a specialist in abrasives sales and service. will continue as sales manager.

Bellinger Forms New Company

Kenneth P. Bellinger has recently resigned as executive vice-president of *The Chemical Corp.*, Springfield, Mass., to form his own company, *Conversion Chemical Corp.*, Rockville, Conn. The new organization will specialize in specialty cleaners and treatments for the metal finishing industry. The company will also represent a number of well-known manufacturers in the metal finishing equipment field.

Mr. Bellinger, who has been associated with The Chemical Corp. for sixteen years as technical salesman, branch manager, technical director and general sales manager, is well qualified to serve the trade. A graduate of Rensselaer Polytechnic Institute with a chemical engineering degree, Mr. Bellinger has a solid background of experience in the industry including original sales development work at Pennsylvania Salt Mfg. Co., on Pennsalt cleaners.

Kenneth P. Bellinger

Metal & Thermit Adds to its Headquarters Staff

Metal & Thermit Corp. has announced the appointment of *Charles H. Carpenter, Jr.*, as assistant manager, Market Development Department. He will be located at the company's home offices in New York.

Mr. Carpenter, a chemical engineer, comes to the firm from American Cyanamid Co. where he served as senior

Charles H. Carpenter, Jr.

market analyst. Prior to that he held positions as chemical engineer, development engineer and group leader, research, at United States Steel.

He attended the University of Virginia three years, received his BS degree from West Virginia University and obtained his master's degree from Bucknell University.

New Quarters for Lustrebright

C. S. Levine, president of the *W. C. Brate Company*, manufacturers of the Lustrebright solution for bright nickel plating, announces new and larger offices at 121 Tivoli St., Albany 4, N. Y. with improved manufacturing facilities, including a railroad siding. The firm was established in 1860.

Wyandotte Chemicals Adds to Service Staff

Herbert Brown and *Richard S. Keen* will serve present and prospective *Wyandotte Chemicals* users in the New York City and Detroit areas, respectively.

Mr. Brown served the U. S. Navy three years, graduated from college in Michigan, and is a member of the New York Chapter of the A.E.S. He has had sales-service experience since 1951 contacting the metal finishing industry in eastern United States.

Herbert Brown

Richard S. Keen

Mr. Keen has attended both Wayne University and Henry Ford Community College. He has been connected with the laboratory testing of plated coatings for Ford Motor for a number of years and received intensive training in product applications at Wyandotte's Research and Technical Service Laboratories.

Metal & Thermit Appointments

Metal & Thermit Corp. has announced that *C. J. Beasley*, formerly controller and assistant secretary, has

C. J. Beasley

C. R. Hervey

been appointed a vice-president and will plan and direct the financial activities of the company. In his new post, the controller and the treasurer will report to him.

C. R. Hervey, formerly assistant controller, has been appointed controller, succeeding Mr. Beasley in this capacity. Mr. Beasley will retain the title of assistant secretary.

353 Diamond Employees Cited

With individual records ranging from one to four decades, 353 employees of Diamond Alkali Company's Painesville (Ohio) Works were cited recently for their long service by this leading producer of basic industrial and agricultural chemicals.

The company awarded diamond-shaped pins to these 353 men and women, whose combined service with Diamond totals 6,425 man-years, a record compiled in less than half a century.

The group honored at the annual service award citation banquet this year marked the largest number of Diamond employees at Painesville ever to be cited at one time in the company's 45-year history. The Painesville Works, the company's oldest and largest facility, is also the world's largest plant of its kind.

Horacek Joins Turco

Joseph Horacek, Jr. has been appointed assistant sales manager of *Turco Products, Inc.*, Los Angeles manufacturer of specialized industrial chemical processing compounds. In addition to general overall sales responsibilities, Horacek will specialize in sales personnel, sales training and new product development.

Horacek comes to Turco after seventeen years with the Hercules Powder Co., where he was most recently in charge of West Coast sales for industrial chemicals, Paper Makers Chemical Department. Prior to that assign-

Joseph Horacek, Jr.

Henry Risko

ment. Horacek was in charge of industrial chemical sales for Hercules' Midwestern Division.

A graduate chemist, Horacek was graduated from Emory University in Atlanta, Ga. in 1934. He is a member of the American Chemical Society and the American Society of Lubrication Engineers.

U. S. Hoffman Appoints Filtration Sales Manager

The appointment of *Henry Risko* as sales manager of the *Industrial Filtration Division*, has been announced by the *U. S. Hoffman Machinery Corp.*, 105 Fourth Ave., New York.

Mr. Risko joined the firm in 1942 as a service engineer in the Industrial Filtration Division and, in 1952, was appointed division service manager. In his new capacity, Mr. Risko will be in charge of sales for the division.

Prior to his association with the company, Mr. Risko fought professionally as a boxer under the name of "Babe" Risko. In 1936, he won the world's championship middleweight title and defended it successfully until 1938. During his ring career, Risko fought in 114 bouts against such ring notables as Billy Conn, Ezzard Charles, and many others.

Mr. Risko, although retired from the contender ranks, is still active on the East Coast as a boxing referee.

Graver Opens New Sales-Service Office

A new sales-service office to serve Detroit, the surrounding industrial area and all of Michigan has been established by the *Graver Water Conditioning Co.*, manufacturers of industrial and municipal water treatment and industrial waste treatment equipment. Office location will be at 17590 James Couzens Highway, Detroit. Telephone is UNiversity 4-7013.

Handling the sales engineering department will be *Arnold Wilcox*, a graduate chemical engineer, who brings with him a broad background of 10 years' experience with suppliers

of water treating equipment. It includes 5 years in research and development and 4 years in sanitary engineering. For the past year he has been associated with the firm's technical department.

J. P. Turner, service engineer, who has been assisting company customers in the Detroit area for the past year and a half, will continue in that capacity. Mr. Turner has been in the water treatment field for 15 years and 10 of these years have been spent with large suppliers of water treating equipment.

Pangborn Quarter Century Club Welcomes Seven New Members at Fifth Annual Banquet

At the Fifth Annual Banquet of the Quarter Century Club of the *Pangborn Corp.*, Hagerstown, Md., seven new members were welcomed by *Thomas W. Pangborn*, president.

With the seven new members, the club's membership reaches 113 or 12% of a total employment of 900 persons. Each new member of the club receives an inscribed gold watch at the banquet.

From left to right, the seven new members joining the Pangborn Quarter Century Club are James L. Keeney, Maxwell F. Poe, Guy M. Elliott, James S. Grove, William A. Byers, Everett C. Gilmour and Louis Hasenbuhler. At the head table stand Lloyd L. Stouffer, P. J. Potter, Thomas W. Pangborn, Victor F. Stine, John C. Pangborn, Helen R. Fisher (directors of the corporation) and the Rev. Walter B. McKinley.

Many sales members of the club journeyed considerable distances to attend the banquet, coming from as far away as the Pacific coast, St. Louis, and Chicago.

David W. Pettigrew Named Administrative Assistant with American Zinc Institute

The appointment of *David W. Pettigrew* as administrative assistant to the *American Zinc Institute, Inc.* has just been announced. Mr. Pettigrew was formerly a sales engineer for Swindell-Dressler, Inc. a Pittsburgh engineering firm.

A 1948 graduate of Carnegie Institute of Technology, Mr. Pettigrew is a licensed Professional Engineer. While an undergraduate at Carnegie,

David W. Pettigrew

he served as metallographer with the Aluminum Co. of America, where he remained for several years after receiving his degree of B.S. in Metallurgical Engineering.

Pettigrew served with the Signal Corps in the Philippines and holds an Army Reserve appointment as Signal Officer. He is an active member of the American Institute of Mining and Metallurgical Engineers. While at Carnegie he was awarded membership in Theta Tau, Omicron Delta Kappa, and Pi Delta Epsilon, national honor societies.

New General Ultrasonics Representatives

The General Ultrasonics Co. of Hartford, Conn. announces the appointment of engineering and sales representatives to cover the New England area for the application of this firm's ultrasonic processing equipment in the fields of electroplating, cleaning, pickling and for research and development purposes.

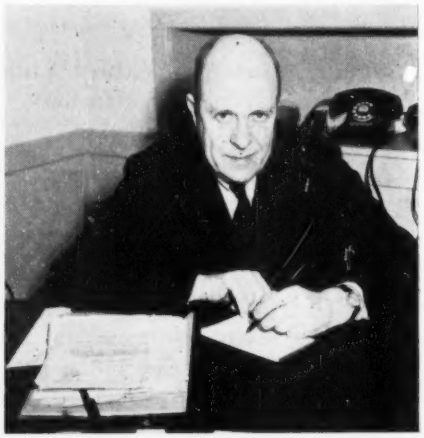
The entire State of Connecticut will be the responsibility of *The MacDermid Sales and Equip. Corp.* of Bristol, Conn.

The States of Massachusetts, Rhode Island, New Hampshire, Vermont and Maine will be covered by *Louis V. Gagnon* who will establish quarters after the first of the year at Framingham, Mass.

ACP Appoints Director of Marketing

John O. J. Shellenberger, vice-president, has been appointed director of marketing of the *American Chemical Paint Co.*, Ambler, Pa.

In his new capacity, Shellenberger will supervise sales and marketing activities of the firm's three main divisions: Metalworking Chemicals, Agricultural Chemicals, and the International Division. He carries into this new position a background of 20 years' experience in metalworking and agricultural chemicals, both at home and abroad.



John O. J. Shellenberger

Mr. Shellenberger joined the firm in 1935 as advertising manager. During World War II on a leave of absence, he served a tour of duty with the U. S. Navy, attaining the rank of Lt.-Commander. Upon his return to the company in 1946, he became manager and then later vice-president and director of the International Division.

Roberts Retires from Diamond Alkali

Walter R. Roberts, for 20 years manager of silicate sales for *Diamond Alkali Co.*, Cleveland, Ohio, retired December 31, 1955.

Succeeding Roberts is *Clifford S. Hancock*, manager of calcium carbonate sales for the past seven years, who will continue in this capacity in addition to taking over responsibility for the sale of all Diamond silicate chemicals excepting detergent silicates, which will now be handled by *C. W. Turner*, manager of detergent specialty sales.

Hancock joined the company at Pittsburgh in 1925 as a clerk in the sales department. In 1929, he was promoted to secretary-treasurer of the Pure Calcium Products Co. at Painesville, a Diamond subsidiary which was later dissolved and integrated with the parent organization. After two years as plant protection officer, he became manager of calcium carbonate sales in 1948.

Turner, who was appointed manager of specialty sales in December, 1954, previously had supervised Diamond sales and service activities for six years. He assumes his broadened responsibilities with a background of 19 years experience in alkali manufacture and merchandising. He joined the firm in 1932 as a laboratory technician in the research laboratories of the company's Painesville plant.

Economy Through Quality Stressed at Oakite Conference

The savings effected in industrial production through the use of quality cleaning materials were stressed in the annual technical sales conference held by *Oakite Products, Inc.*, in New York City, November 17 through 19.

Representatives from the company's New York, Canadian, Philadelphia, and New England divisions shared their experiences in serving the cleaning needs of industry.

J. J. Siefen Co. Adds to Sales Staff

Alfred Darnell

Louis Misenti

Donald A. Gaines

The *J. J. Siefen Co.* of 5657 Lauderdale St., Detroit 9, Mich., manufacturers of liquid buffing and polishing compounds and spray buffing equipment, announces the appointment of *Alfred Darnell* as salesman for the Illinois-Wisconsin Territory. Mr. Darnell was formerly in the New England Territory.

Louis Misenti has been appointed salesman for the Central New York Territory. He was formerly with the Harper Buffing Machine Co. and Packer Machine Co.

Donald A. Gaines is now salesman for the New England territory. He was formerly with the *Michigan Buff Co.* in the same territory.

Stauffer Promotes Begley

The promotion of *James H. Begley*, effective January 1st, to Western Division sales manager for industrial chemicals of the *Stauffer Chemical Co.*, was announced recently.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

New York Branch

The *Annual Educational Session and Banquet* of the New York Branch of the *American Electroplaters' Society* will be held on Saturday, February 11, 1956 at the Sheraton-Astor Hotel, Times Square, New York City.

The schedule is as follows:

Educational Session —2::30 P.M. to 5 P.M. at the "South Garden"
Ladies Party (afternoon) — 3 P.M., tenth floor
Banquet—7:30 P.M. in the Belvedere Room.

Educational Program

1. "New Developments in Levelling Nickel Processes"—*Dr. D. G. Foulke, Hanson-Van Winkle-Munning Co.*
   A technical discussion will be made of recent developments in levelling nickel, which offers a third major type of nickel alongside Watts and organic bright nickels. Some of the technical data on the properties of this kind of nickel will be presented, and examples will be shown.
2. "A Shop Test for De'ermining Cleaning Time"—*Dr. H. B. Linford, Columbia University.*
   As a result of recent work on A.E.S. Project 12, a new shop test has been developed. This test permits the plater to determine how long it will take his cleaner to remove any particular oil or grease. This test is based on the rate of spreading of various oils and lends itself to field use.
3. "Current Trends in Washington on the Nickel Situation" — *H. Hirschman, Dept. of Commerce.*
   Mr. Hirschman, of the Nickel Division of the Dept. of Commerce, will discuss present developments in the nickel supply situation. The present picture on uses of nickel will be discussed, followed by discussion of future trends. The role of decorative nickel plating in the event of government controls will be given.

Tickets and reservations may be obtained by writing to: *Milton Nadel*, 41-15 50th Ave., Long Island City, N. Y.

Newark Branch

A meeting of the Newark Branch was held on November 18, 1955 at the Robert Treat Hotel with all officers except *John Gumm* and *Clifford Struyk* present. Elected to membership were *Sydney Willoughby* of Weston Electrical Instrument Co., and *Arthur Atwater* of the Bell Telephone Laboratories, Inc. The resignation of *Wm. W. McCord*, a member of the A.E.S. for some 30 years was regretfully accepted and *T. A. Downey* was transferred to the Grand Rapids Branch. President *Tom Austin* called upon *Wm. Grigat* for a report on the Christmas Party to be held in December. He reported the arrangements almost complete, a three-act floor scheduled, a roast beef dinner planned and a good time guaranteed. *George Wagner* said the tickets would go out next week and *Don Foulke* asked those receiving Boosters' letters to reply promptly. *Dodd Carr*

reported that three classes remained in the Fall Electroplating School and attendance continuing at a high level.

Following the showing of the interesting film "A Brighter Tomorrow" by the Bart-Messing Enterprises, Librarian *Gustave Bittrich* then introduced *Robert Horrocks* who described the Bendix Teterboro plating room recently completed, including the special engineering and tank arrangement.

Dr. Abner Brenner then described "Research at the Bureau of Standards." Starting with the origin of the Electrodeposition Section under *Dr. Wm. Blum* the speaker outlined the scope and growth of the section over the years. Dr. Brenner then reviewed recent work including the electrodeposition of metals from non-aqueous solutions, using fused salt and organic electrolytes, permeability studies and later radioactive and X-ray techniques; protecting magnesium from corrosion, touching upon the HAE Process, Dow No. 17 and the Bureau's alkaline dichromate solution; and the protection of molybdenum at high temperatures by use of chromium plus nickel barriers. Dr. Brenner also touched briefly upon electrophoretic deposition of colloid materials.

The interest of the 68 members and guests was shown by the many questions raised.

D. Gardner Foulke
Secretary

Chicago Branch

Chicago Branch has always looked upon *Leonard Weeg* of National Lock Co. as an old and respected friend and, when he appeared before them as a speaker for the November meeting, he discussed an old subject, yet managed to give it a "new look." With the emphasis now upon brass finishes for Modern Design there is a renewed interest in improving brass plating techniques. Though Mr. Weeg's approach to the subject was "Brass Finishes on Hardware," his coverage was applicable to all phases of brass plating. The stress was on modern methods for meeting tight production schedules while still maintaining quality and uniformity. Mr. Weeg was assisted in this presentation by *Gail Pearson*, plating foreman at National Lock Company.

The Experts Panel for this meeting was replaced by a very informative discussion and actual demonstration of pump packing techniques conducted by *Harold Faint* of Frederic B. Stevens, Inc. *Ray Ledford* of Industrial Filter was ill and could not participate as planned in demonstrating the Cut-Away Unit, but promised to bring it before the branch at an early date. Among the points Mr. Faint covered were placement of packing, alternating ring splits, location of lantern gland, use of water seal, and restriction to 5 to 10 lbs. head.

President *S. P. Gary, Jr.* extends to all friends of Chicago Branch a cordial invitation to attend its 44th Annual Educational Session and Banquet to be held Saturday, January 28, 1956 at the Conrad Hilton Hotel in Chicago. The branch librarian, *Dr. Russell E. Harr of Western Electric Co.*, has planned an excellent program for the afternoon, headed by *R. S. Wysong*, of Studebaker-Packard Corp., as moderator with the following speakers:

1. "Engineering Uses of Plated Coatings." *Phil J. Ritzenthaler*, President, Plating Engineering, Milwaukee, Wis.
2. "Decorative Anodizing." *Joseph M. Andrus*, Chief Chemist, Croname, Inc., Chicago, Ill.
3. "A Progress Report on Accelerated Corrosion Tests for the Performance of Plated Coatings." *Walter Pinner*, Executive Staff Engineer, Houdaille-Hershey Corp., Detroit, Mich.

For the evening, the banquet chairman, *R. Scott Modjeska*, of Scientific Control Laboratories, promises an unusually gay evening with an excellent dinner, followed by a star studded show M.C'd by Lou Breeze. To complete the evening there will be dancing to the music of Lou Breeze and his orchestra.

Jerome Kuderna
Publicity

Pittsburgh Branch

The November meeting of the Pittsburgh Branch was held in the Avalon Room of the Sherwyn Hotel on November 2nd. At the dinner preceding the meeting *Ed Smith* won a free dinner by being present and *Dave Porter*, by being absent, missed a very fine free meal.

At a short business meeting we were pleased to welcome four new members into the branch, *Elmer A. Lord, A. John Cornish, Collin F. Sevens* and *Ty Nitsche.*

Since there was no new or old business the meeting was turned over to Librarian *Jim Crain* after a few announcements. Jim introduced the speaker for the evening, *Clarence H. Sample* of the International Nickel Co., Inc., who talked on "Corrosion Behavior and Protective Value of Electrodeposited Coatings." Clarence's fine talk was well illustrated with a set of beautiful colored slides.

After a short pause for refreshments, Clarence drew the name for the door prize. *Charley Forbes* was the fortunate winner of a beautiful chafing dish presented by *Carl Reinheimer* of Westinghouse Electric Corp., Electroplating Projects Dept. After a lively discussion period the meeting was adjourned.

Herb Schram
Secretary

Indianapolis Branch

The December 7, 1955 meeting was attended by thirty-two members and guests. Delicious steaks were enjoyed by all at the Fox Steak House. Guests included: *H. Voldner*, R.C.A. Victor, Ltd., of Smith Falls, Ontario. First-vice-president *Bert Hawhee* presided in the absence of President, *Herb Kennedy*, who was absent because of illness of his mother. After the usual opening procedure and reports by the secretary and treasurer, one new member was voted into the society. He was *Addison N. Howard*, 169 N. Indiana St., Mooresville, Ind. This motion was made by *Les Reynolds*, seconded by *Abraham Max* and carried. One transfer was announced and this was for *Richard W. Priddie* from the Philadelphia Branch. He is employed by Snap-On Tools Corp. of Mt. Carmel, Ill.

New business included the following:—

Announcements of the Chicago annual meeting on Jan. 28, 1956; of *Duke Wysong's* candidacy for 3rd vice-president. Report of delegates to last summer's convention. This was given by Mr. Reynolds and Dr. Max. A report was also given by *Frederick Anderson* on the Tri-State business and plans.

Since the president was absent, some business was left until the January 1956 meeting. This will include the election of delegates for the year 1956.

The program was given by *Clayton*

Marks of Clayton Marks, Inc., Chicago, Ill. His topic was "Acid Zinc." With seventeen years experience of operating this type plating, Mr. Marks was well versed on this topic. He told of every phase of operation, how the solution was controlled, the kind in materials plated, the brightness or dullness of the plate and compared it with cyanide zinc. The group had many questions to ask about this type solution.

After refreshments the meeting adjourned at 9:30 P.M.

Edna Rohrabaugh
Secretary

Los Angeles Branch

Los Angeles Branch wound up its 1955 meeting schedule with the first Ladies' Night in the 26 year history of the branch on the night of December 14.

The scene was the Conference Room of the Rodger Young Auditorium on Washington Blvd., Los Angeles. All business and technical matters were outlawed for the evening in order to show the ladies a good time. First Vice-President *E. Truman Stoner*, who presided in the absence of President *Earl Arnold*, even refused to have the "minutes of the last meeting" read and confined the proceedings to programmed entertainment items.

A social period from 6 to 7 o'clock preceded a Smorgasbord dinner. An entertainment program followed, featured by the showing of several interesting domestic and foreign travel films.

Among the guests was *Herman J. Struckhoff, president* of the Metal Finishing Suppliers' Assn., Inc., who was elected to that post at the M.F.S.A. convention which was held jointly with the A.E.S. convention in Cleveland, O., last June. Mr. Struckhoff has since moved from St. Louis to Los Angeles where he has established himself in the plating process and equipment business.

Among the ladies present were *Mrs. Carroll McLaren, Mrs. Peter Esten* (who assisted Sergeant-at-arms husband Pete in the dispensing of dinner tickets), *Mrs. Glen Beckwith, Mrs. Alex Heller, Mrs. Lawrence O'Neil, Mrs. Norman McKewan, Mrs. W. P. Ellis, Mrs. Harold Boyd, Mrs. John Merigold, Mrs. Josephine Crespi, Mrs. Verona Chaplo*, and *Mrs. Alma Ibanez.*

Conventional business and technical sessions of The Branch will be resumed at the January 11 meeting for which Librarian Norman McKewan has promised an outstanding speaker on a currently significant subject in the plating field.

A number of applications for membership were filed at the December meeting, but were held over for action until January. Membership Chairman Stoner reported to METAL FINISHING that the drive for new members is proceeding with gratifying progress and that the goal of 100 new members, which was set at the September meeting, has excellent prospects of being achieved before the drive ends in March.

Pittsburgh Branch

The December meeting of the Pittsburgh Branch was held in the Avalon room of the Sheraton Hotel. Neither recipient of the two free meals was present at the dinner so they lost their Christmas bonus.

At a short business meeting we were pleased to receive three new applications for membership from *John Mechtly, Robert Hartung* and *Edwin*

Sokalski. Also, the budget was reviewed, the bid to print the new By-Laws booklet was accepted and it was decided to transfer some of the branch's funds to a savings account.

In the absence of Librarian *Jim Crain*, 2nd Vice-President *Fred Dixon* introduced our speaker for the evening, *Kenneth M. Huston*, Armco Steel Corp., who talked on "Surface Finishes for Stainless Steel." Ken gave his usual fine talk about his favorite subject.

After the short pause for refreshments, Ken drew *Rex Goldbach's* name for the door prize, a beautiful Kodak Duoflex Camera with flash gun and accessories presented by *Bill Pizoli* of Oakite Products.

Herb Schram
Secretary

NATIONAL TECHNICAL TASK COMMITTEE ON INDUSTRIAL WASTES

Report of the Electroplating Industry to Task Group III, December 1, 1955

The electroplating industry is able to report continuing progress toward pollution abatement during 1955. The literature on plating wastes contains a markedly increased number of accounts of construction and operation of full-scale treatment plants.

Analytical Methods. The analysis of electroplating wastes is reasonably well covered in the 10th edition of "Standard Methods for the Examination of Water, Sewage, and Industrial Wastes," issued during 1955. Any dissatisfaction with this book and suggestions for improvement should be reported where they will do some good. There is, for example, in the Federation of Sewage and Industrial Wastes Associations, a Committee on Standard Methods, with subcommittees on cyanides and metals as well as on other specific analyses

Additional journal articles on analytical methods have appeared during 1955, by Serfass (Lehigh University), Shaw (University of Texas), and others.

Treatment Methods. The treatment methods developed during recent years remain popular. There is increasing attention to waste reduction by materials salvage operations and good housekeeping in the factory. Chlorination is the most common method of destroying waste cyanides.

Applications of ion exchange are increasing, principally because this technique abates pollution by recovery of useful materials. Evaporation is being used to concentrate chromate wastes in several plants, and was reported during 1955 for the concentration and recovery of zinc cyanide liquors.

Research. The principal sponsored research on plating wastes is that of the American Electroplaters' Society. Currently, attention is being given to the kinetics of cyanide oxidation by ozone. This work is being conducted at Yale University under the direction of Professor B. F. Dodge.

Destruction of cyanide wastes by bacterial action has been investigated in England, and a summary report was presented at the 1955 Purduce Conference. Related experiments, sponsored by the National Institutes of Health, are under way at Michigan State University.

The toxic effects of plating-room wastes, in streams, in water supplies, and in sewage treatment plants, are being investigated more intensively than previously. Typical of this research are studies completed or now in progress at the Academy of Nat-

ural Sciences of Philadelphia, relating to the synergistic effects of temperature, pH, and hardness on the toxicities of copper, zinc, cyanide, and combinations of these constituents.

C. Fred Gurnham, Delegate
D. Gardner Foulke, Alternate

N.A.M.F.

The *National Association of Metal Finishers* has announced the topics to be included in its *Management Seminar*, scheduled for Friday and Saturday, January 27 and 28, 1956 at the Conrad Hilton Hotel, Chicago. The program will include five sessions highlighted by a banquet on Friday evening at which Representative *Sidney Yates* (Illinois) has been invited to speak as a member of the *House Select Committee on Small Business* on the current problem of availability of nickel. Other topics will be "*Wage Incentives*," "*Methods of Quality Control in a Job Shop*," "*Fringe Benefits —1956 Model*," and "*What the Purchasing Agent Expects of a Plater*."

In conference sessions scheduled for both afternoons, men attending the Seminar will have an opportunity to discuss their individual company problems with guest experts on ten specific subjects. These are "*Business Insurance*," "*Ventilation in the Job Shop*," "*Labor Relations*," "*Flooring Problems*," "*Executive & Supervisory Bonuses and Distribution Plans*," "*Office and Shop Forms and Procedures*," "*Employee Testing*," "*Taxes*," "*Sanitary Maintenance*," and "*Group Insurance*."

Attendance at the event is limited to the owners and operators of job-shop metal finishing firms and the managers of finishing departments of manufacturing firms. It is expected that over two hundred firms from all parts of the country will be represented.

THE AMERICAN SOCIETY FOR TESTING MATERIALS

Committee B-8 announces a symposium which will occur on Wednesday, February 29 at the Hotel Statler, Buffalo, N. Y. The symposium will be of special interest to executives, engineers and others involved in the production, testing and use of plated coatings. Eight papers will be presented at a morning and afternoon session and will cover a variety of subjects including a summation of performance data obtained from testing various combinations of copper - nickel - chromium; also lead, cadmium and zinc coatings and chemical conversion coatings of the latter metals. Also included will be considerations of such matters as metal cleaning procedures, evaluation of the salt spray test method and work related to certain physical properties of plated coatings. Membership in A.S.T.M. is not required for admission. The Society is extending an invitation for attendance by all who are interested, with no registration fee involved.

Symposium Program

Hotel Statler, Buffalo, New York
February 29, 1956 — Chairman, *W. L. Pinner*

Morning Session: 9:30 A.M.

1. Introductory Remarks by the Chairman.

2. "History of A.S.T.M. Committee B-8," *William Blum*, Retired (formerly Director of Chemistry Section, National Bureau of Standards).

3. "Corrosion Behavior and Protective Value of Decorative Copper-Nickel-Chromium and Nickel-Chromium Coatings on Steel," *C. H. Sample*, International Nickel Co.

4. "Evaluation of Methods Available for Measurment of Surface Luster in Plated Coatings," *Glade Bowman*, Standard Steel Spring Div., Rockwell Spring and Axle Co.

5. "Metal Cleaning Prior to Electroplating," *S. Spring*, Pennsalt Mfg. Co.

Adjournment for Luncheon

Afternoon Session: 2:00 P.M.

6. "Comparison of the Corrosion Behavior and Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel," *C. H. Sample* and *R. B. Teel*, International Nickel Co.: and *A. Mendizza*, Bell Telephone Labs.

7. "Evaluation of Supplementary Conversion Coatings on Zinc and Cadmium," *R. E. Harr*, Western Electric Co.

8. "Atmospheric Exposure of Electroplated Lead Coatings on Steel," *A. H. DuRose*, Harshaw Chemical Co.

9. "The Standard Salt Spray Test—Is It a Valid Acceptance Test," *A. Mendizza*, Bell Telephone Labs.

AMERICAN ZINC INSTITUTE

Ernest V. Gent, who has served the American Zinc Institute for 20 years first as secretary then as executive vice-president, retired from office on December 31. *John L. Kimberley*, secretary of the Institute, has been appointed executive vice-president in his stead and took office January 1, 1956.

Ernest V. Gent

John L. Kimberley

Mr. Gent has been active in zinc industry affairs since 1925 when he was manager of the Zinc Export Association. He became secretary of the American Zinc Institute in 1935, and in 1941 was called to Washington to serve as special consultant to government agencies concerned with defense and war efforts. He has served as executive vice-president since 1948. Commencing with the new year, Mr. Gent will continue to serve the Institute as a special consultant.

Mr. Kimberley was elected secretary of the Institute in April of this year. He was formerly sales manager, Continuous-Cast Alloy Products Division of the American Smelting and Refining Co., and before that was a metallurgist with the Scovill Mfg. Co. Between 1942 and 1944 he served with the War Production Board and the U. S. Navy. He is a graduate of Yale with a B.S. in Mechanical Engineering and an M.S. in Metallurgy.

Manufacturers' Literature

Tungsten Carbide Coatings for Buffing Fixtures

Fusion Metal Coating Co., Inc., Dept., Dept. MF, 25493 West Eight Mile Road, Detroit 19, Mich.

A booklet giving general information and precedure sheets for the application of Fusecoat "T" coatings of tungsten carbide is available from the above manufacturer, who furnishes a coating service. All work on fixtures is done at their plant. The booklet describes the applications of the process and gives the procedure followed in applying the tungsten carbide coatings.

Solvent Degreasing

Circo Equipment Co., Dept. MF, 51 Terminal Ave., Clark Township (Rahway), N. J.

A variety of published material giving detailed information about the above firm's extensive line, and several technical papers on ultrasonic degreasing equipment have been prepared and are available for immediate distribution.

Industrial Chemicals

Metal & Thermit Corp., Dept. MF, 100 East 42nd St., New York 17, N. Y.

A new 6-page, 2-color bulletin, C197R, describes the characteristics and uses of the above manufacturer's extensive line of chemicals and other products derived from tin, antimony and zirconium.

Product groups described include inorganic and organic tin chemicals, organotin stabilizers, stannous soaps, antimony chemicals, zirconium products and various metals and alloys. Several newly introduced tin derivatives are grouped separately for ready identification under the heading "New Chemicals."

The brief descriptions of each chemical include physical and chemical properties such as form, solubility, dehydration temperature, percentage of tin content, etc., where applicable and a careful listing of the uses. Applications are listed for end uses in the chemical industries, immersion tinning and electroplating, ceramics, textiles, paints and other products.

The bulletin also offers technical advice and assistance in solving problems pertaining to both existing applications and prospective uses.

Sulfamate Nickel Plating

Hanson-Van Winkle-Munning Co. Dept. MF, Matawan, N. J.

A new 16-page technical bulletin describes the sulfamate nickel plating process. The bulletin describes solution preparation, listing optimum and limit amounts for each ingredient; effects of constituents in producing deposits; effective temperatures, current densities and voltage requirements;

purification methods: equipment and materials used; and analytical procedures for four constituents.

Eight photomicrographs compare metal deposits under different plating conditions. Six graphs covering different temperatures and current densities describe deposit characteristics.

Flexible Exhaust Hose

The Flexaust Co., Dept. MF, 100 Park Ave., New York 17, N. Y.

Bulletin 50 describes the firm's flexible hose for the metal working industries, where ventilation, dust and fume control are needed.

Selenium Rectifiers

Clinton Supply Co., Rectifier Mfg. Div., Dept. MF, 110-112 S. Clinton St., Chicago 6, Ill.

The above firm has issued literature on its selenium rectifiers, featuring the Dual-O-Matic voltage selector switch. Components and prices are listed, as well as an illustration of the cabinet, with dimensions for each model.

Abrasive Belt Applications

Engelberg Huller Co., Inc., Dept. MF, 831 W. Fayette St., Syracuse 4, N. Y.

"How Abrasive-Belt Grinding Increases Production," is a new 31-page booklet consisting of 46 illustrated case histories.

Application studies are grouped according to each of five types of abrasive belt machining, platen, contact wheel, formed wheel, centerless, and flexible belt, and cover a wide range of materials, ferrous and non-ferrous metals, glass, wood, and plastics.

Each abrasive belt grinding illustration is accompanied by a close-up shot of the ground parts.

Weather-Fast Colors for Anodized Aluminum

Sandoz Chemical Works, Dept. MF, 61 Van Dam St., New York 13, N. Y.

Colors for anodized aluminum that resist fading from sunlight and outdoor exposure are shown in a brochure describing the anodizing, dyeing and sealing procedures necessary to obtain maximum light fastness.

The brochure includes samples of five colors found by the above manufacturer to be most suitable for outdoor use selected after exhaustive tests made in hot Arizona sunlight, under ultra-violet carbon arc lamp and outdoor exposures up to seven years duration.

Neoprene Sprayed Coatings and Sheet Linings

Protective Coatings Div., Metalweld, Inc., Dept. MF, Scotts Lane & Abbottsford Ave., Philadelphia 29, Pa.

A new bulletin outlines the protective qualities of Neoprene in applications affected by sunlight, heat, abrasion, oil, cold and various chemicals. Included in the bulletin is a table on organic chemicals for which Neoprene lined tanks and piping can be recommended.

Article on Plating Waste Treatment

Graver Water Conditioning Co., Dept. MF, 216 West 14th St., New York 11, N. Y.

A new and highly informative technical article T-136 on plating waste treatment is now available from the above company. The article, entitled "Plating Waste Solutions — Recovery or Disposal," discusses the two possible mthods of treating plating wastes by ion exchange or precipitation. The paper goes into the details of the costs involved, space requirements and other important data required for a sound choice between the two methods.

There are two useful monographs on estimating chemical recovery and the value of the recovered water. Other illustrations show typical plants and details of equipment.

Protective Coatings

Amercoat Corp., Dept. MF, 4809 Firestone Blvd., South Gate, Cal.

A new illustrated catalog describes the various corrosion resistant coatings systems manufactured by the above company. Suggestions in regard to the selection of the proper protective coating and the preparation of coating specifications are outlined.

Corrosion Resistant Pipe

Alpha Plastics, Inc., Dept. MF, 15 Northfield Rd., West Orange, N. J.

Two folders show fully detailed reference information for proper selection of unplasticized, rigid polyvinyl chloride pipe, where high chemical resistance and/or high impact resistance is desired.

The two types, Alpha 101 and Alpha 102 are described in the first folder together with charts showing their mechanical, thermal, electrical and other desirable properties. Also introduced, is the above manufacturer's new, pressure-rated, Schedule PR-150 rigid p.v.c. pipe which offers the same working pressure in every size, from ½" to 4". Installation data, plus an A to Z range of applications chart listing the many diverse industries where rigid, corrosion-resistant pipe is recommended, is included. A special

table shows the pipe's resistance by field tests, to a wide range of frequently encountered, "problem" chemicals. Installation procedures are also described.

A companion folder describes and illustrates threaded and socket solvent cement fittings recommended for use with the p.v.c. pipe. Ordering information and other helpful data are provided.

Packaged Boilers

Eclipse Fuel Engineering Co., Dept. MF, Rockford, Ill.

Bulletin No. A-1041 contains complete information on the new "Red Band" line of Scotch-type steam boiler plants.

All the various features of this line of packaged boilers are presented in this bulletin. The complete range of sizes is pictured from the 12 h.p. unit to the 125 h.p. boiler. Operating characteristics of the gas, oil, and gas-oil burners are discussed along with recommendations for application of the new units.

Control Transformers

General Electric Co., Dept. MF, Schenectady 5, N. Y.

A new 32-page catalog describes the complete line of G-E control transformers.

Including autotransformers, machine tool transformers, and special application models, the illustrated publication is designated GED-2767. It contains ratings, dimensions, product features, and model numbers. Also included are list prices, weights, and wiring diagrams. A special section shows panel and machine tool voltage regulation curves for use in selecting the proper transformer for given applications.

Transmitter for Closed Tank Level Measurement

The Foxboro Co., Dept. MF, Foxboro, Mass.

A new 8-page bulletin, 13-22, describes closed tank liquid level measurement and control with the recently announced Type 13 LA d/p cell liquid level transmitter.

In addition to diagrams showing principle of operation and suggested installation layout, the bulletin lists complete specifications and dimensions. Also included are illustrations of other liquid level components such as indicators, recorders and control valves.

Water Softeners

Hagan Corp., Dept. MF, 323 Fourth Ave., Pittsburgh, Pa.

Water softeners for industrial plants, institutions, and commercial establishments, are described in a bulletin just issued. Cutaway drawings illustrate the construction of the softeners, and indicate the simple connections by which a softener is fitted into a water system. The capacities of the various models are given, together with other specifications of each model.

Heat Exchangers

Carl Buck & Associates, Dept. MF, Essex Fells, N. J.

A new catalog gives complete data on Camac heat exchangers for all plating, pickling and anodizing solutions. The catalog lists all solutions used and proper materials of construction to give satisfactory performance. Included are formulae for determining size of unit needed for any heating or cooling load. Simplified heat loss and steam temperature tables as well as dimensioned sketches facilitate selection of the proper unit for controlling temperature in any metal finishing process bath.

Nickel Plated Steel

The Colorado Fuel & Iron Corp., Dept. MF, 575 Madison Ave., New York 22, N. Y.

A twelve-page technical manual on Bart Lectro-clad nickel-plated steel presents a technical description of the nickel-plated products, covering manufacturing techniques and fabrication procedures, including forming, welding, cleaning, handling and testing methods.

Materials Handling

Nutting Truck and Caster Co., Dept. MF, Faribault, Minn.

In addition to the unusual application of balance style trucks to trailer-train operation, this literature, Jr. Catalog 56 G, illustrates 49 different models of two wheel and platform trucks, 12 types of dollies and 15 styles of casters. Many application photos and complete specifications on each item provide concise product data.

Automatic Ultrasonic Cleaning Machine

Circo Equipment Co., Dept. MF, 51 Terminal Ave., Clark Township (Rahway), N. J.

The story of how automation and ultrasonics, two of the newest production tools available to industry, have been combined to secure assembly line cleaning at a large auto-parts man-

ufacturer is told in a new folder, Bulletin "55A. Complete installation and operating details for the large, continuous production ultrasonic cleaning machine, described as the first known of such magnitude, are included.

The article covers the principles of sound wave production and sonic cleansing, the mechanical transfer of work to and from the cabinet, the various dirt and grease removal stages, capacity, output and operating characteristics. Economy factors relating to the system's speed and efficiency, are also outlined.

Installation photographs show the cleaning machine in relation to the small parts feed line which brings dirt, oil and grease-laden steering gear components into the unit, and the exit conveyor carrying clean and dry parts ready for assembly. Closeups of the loading shuttle and other automatic transfer stages show with clarity how this large ultrasonic apparatus smoothly adapts to the requirements of sustained, mass production.

Buffing and Polishing Compounds

Hanson - Van Winkle - Munning Co., Dept. MF, Matawan, N. J.

Characteristics and uses of over 100 buffing and polishing compounds are described and illustrated in a new bulletin, Co-103.

Listing the above firm's complete line of compounds, the 24-page two-color bulletin contains a full page chart which recommends cutting, coloring and double duty compounds to be used with twelve different metals, plastics and hard rubber.

Specific compounds are classified and described, with recommended usage, under the general headings of tripoli, cut and color compounds, steel and stainless steel buffing compounds, emery paste and cake, crocus, polishing lubricants, rouges, greaseless compounds and special buffing and polishing compounds.

Thirty-five photographs illustrate various compounds. A full-page diagram shows a typical installation of the manufacturer's automatic Liquimatic buffing equipment.

ABSTRACTS

(*Continued from page 71*)

Rough Deposits from Cyanide Copper Baths

W. Roggendorf, *Metallwarenindustrie und Galvantechnik*. Vol. 45. No. 12, pp. 608.

In cyanide copper baths the following conditions can cause coarsely crystalline, rough deposits:

1. Lack of sodium sulfite or bisulfite;

2. Too low a pH value;

3. Too high a content of foreign salts, for example, carbonates, sulfates, fluorides.

Lack of sodium sulfite or bisulfite in the bath can, of course, be corrected by addition to the bath. The pH can easily be adjusted to the correct figure by the addition of pure caustic soda. The excess foreign salts must be precipitated by solutions of barium oxide-hydrate or barium cyanide and this is added to the bath at 20° to 30°C. with stirring; the bath is then filtered. With the hot copper cyanide baths which work with high current densities, particularly with the hot bright copper baths which work with a high copper metal content and low cyanide content (4-10 g./l.), care must be taken that the anode surface area is sufficiently high. In hot copper baths the anode area should amount to double that of the ware being treated. If the anode surface area is too small, the anodes passivate too quickly and the bath voltage rises.

The following papers were read at a conference on surface finishing and treatment, held October 1954 at the *Haus der Technik*, Essen, Germany.

Chemical and Electrochemical Surface Treatment Processes

By W. Wiederholt

The function of chemical and electrochemical surface treatment is to provide satisfactory characteristics to the material and its surface. Defects on surface treated parts can be avoided by choice of the material and suitable pretreatment.

All chemical and, frequently, electrochemical processes are based on reactions between the metal being treated and the treatment medium. Uniform and sufficiently dense coatings can only be obtained if the treatment medium acts at all parts of the surface simultaneously and with the same reaction speed. Certain requirements are, accordingly, imposed on the treatment medium and on the course of the reaction, so that defect-free coatings can be obtained.

The author considered the fundamental requirements of material and treatment mediums and discussed progress developments in the field of chemical surface treatment (phosphating of steel, chromating of zinc, as well as processes for the production of metallic coatings (plated, dipped, hot-dipped, sprayed, clad, diffusion, and vacuum deposited) as well as the anodic oxidation of the light metals.

Cleaning and Pretreatment Processes

By H. Rogner

The author discussed cleaning mediums as well as the necessary clean-

ing equipment. There are used as metal cleaning agents either organic solvents, inorganic alkaline cleaners, or emulsion cleaners, as well as water-soluble organic solvents. Cleaning equipment with pure solvent covers immersion or condensation layouts and, with inorganic alkaline cleaners, diversified equipment is used of the boiling, flush, spray, or drum type as well as vapor-flow apparatus and equipment for electrolytic cleaning. Theoretical consideration allows of conclusions being drawn regarding the cleaning processes, particularly with alkaline cleaning. While the pure solvent cleaners, by virtue of their solvent action, act in a degreasing and deoiling manner, cleaning with alkalies is effected dominantly by an emulsifying and dispersing procedure. The organic wetting and emulsifying agents added to many alkaline cleaners reduce the surface tension of the water and accelerate in this way the emulsifying action and, accordingly, the complete cleaning process.

Emulsion cleaners and what are termed water-soluble organic solvent cleaners occupy an intermediate place. Emulsion cleaners are usually hydrocarbons in water, with the use of water-hardness-sensitive or insensitive emulsifiers. They are used generally in the warm spray processes. The water-soluble, organic solvent medium cleaners are similar in structure. By these is understood mixtures of suitable organic solvents with the addition of emulsifiers which are soluble in these. These products (which are also known as cold cleaners) are used for room temperature cleaning, the ware being either placed in the solution or else this is applied by a spray. With subsequent spraying of the parts with water, an oil-in-water emulsion is formed on the metal surface with the cold cleaner residues and the oily and fatty impurities dissolved in this, the result being that the dirt is rinsed away in a water-soluble form.

Pickling Methods

By F. J. Heinrich

After mention of the use of pickling treatments, the author discussed the various requirements for pickling, as related to other surface treatments. Inasmuch as pickling is applied as a pre-stage process prior to further surface treatment, the technical questions which are primarily concerned are adhesion characteristics, purity, and roughness of the surface.

By means of passivating pickling, there results a chemical modification of the surface characteristics and, with the use of phosphoric acid pickling, this consists in the formation of a thin, iron phosphate coating. This has proved particularly useful as a bonding surface for paints. The characteristic data of the various acid pickling processes were then compared and their application discussed as well as the regeneration of the baths. Phosphoric acid pickle baths are now also regenerated by ion exchange, which gives greater technical importance to this process. Electropickling processes were finally discussed.

The following papers were read at the Corrosion Conference held November 1954 at *Frankfurt am Main, Germany.*

Prevention of Corrosion of Metal Parts in Storage and Shipment

By G. Schikorr

The type of corrosion dealt with in this paper is of great practical importance. Thus, for example, in the technical literature one report stated that over 36% of scrap was caused in a consignment of metal goods to South America on account of corrosion. The causes of such corrosion can be traced back to manufacturing shortcomings in the way of insufficient rinsing water, pickling and soldering residues left on the parts, and finger prints. Mostly, however, external influences are chiefly responsible and, in particular, the humidity of the surrounding air, sulfuroxy gases and sea water spray mist. The packing material itself also is not above suspicion; even this can attack the ware.

Corrosion can be fundamentally prevented or reduced by suitable climatization of the storage and shipping rooms. Frequently, packing or transport containers are used in which corrosion-preventing conditions exist. The most suitable process consists in the fact that the ware is covered with suitable protective coverings. Generally, these consist mainly of hydrocarbons which contain addition agents, particularly corrosion inhibitors. Removable coatings of cellulose acetate or butyrate are also used. A series of precautionary measures is absolutely necessary for the successful application of these protective measures. In particular, the ware must be perfectly clean.

Present Position of Phosphating of Steel and Non-Ferrous Metals

By W. Machu

Phosphating is achieved by treatment of the suitably cleaned metal with a weak phosphoric acid solution of the primary phosphates of zinc, manganese, or iron. The "short time" bath, which is used exclusively today, contains accelerating agents in addition. Very thin phosphate coatings can also be achieved with solutions of

sodium or ammonium phosphate. The phosphating is generally conducted at elevated temperatures but "cold phosphating" is possible with baths of higher concentration.

Thicker or thinner phosphate coatings are obtained according to the composition of the phosphating bath or the treatment time. Thick coatings of over 100 mg./sq. dm. for nails, screws and similar parts are oiled, while the thin phosphate coatings of 25-75 mg./sq. dm. form adhesion surfaces for paint finishes. In addition to corrosion protection, the phosphate coatings serve also for the reduction of friction of machine parts which slide on one another. These coatings of iron and manganese phosphates are used in combination with lubricants. Another important application is the use of phosphate coatings as a pressing and drawing aid with the cold working of steel, with deep drawing and shaping processes.

Initial Corrosion of Metals in Contact with Aqueous Solutions at Room Temperature

By F. Toedt

With a broad consideration of the initial corrosion of metals in contact with aqueous solutions, two cases can be differentiated:

1. The corrosion is first slight and then increases. The cause is the gradual exposure of nobler admixtures by which the local cell action rapidly rises.

2. The corrosion is great at first and rapidly decreases and the value attained is ultimately one at which the corrosion does not proceed. The cause of this is a covering with a nobler oxide which forms local cells with uncovered, less noble parts of the metal surface.

Inhibition and Inhibitors

By H. Fischer

The more recent developments in processes for the prevention of corrosion necessitate the re-examination of the concepts of inhibition and inhibitors, to bring these into more general agreement with practical experience and technical terminology. By corrosion inhibition is implied those restrictive reactions of metal corrosion which are actuated by one or more materials (corrosion inhibitors). They can be added to the corrosion medium for the purpose of inducing inhibition or they may previously be presnt, partially or completely. Corrosion inhibitors are materials which form a protective film on the metal surface (but the film itself is not the inhibitor). Differentiation can also be made between physical and chemical inhibitors. The mechanism of physical and chemical inhibition, their existence and field of application were then discussed in detail.

Reduction of Acid Attack on Zinc by Inhibitors

By W. Wiederholt

Zinc is electrochemically less noble than iron. Corresponding to this, the solution rate in acids is greater and the restrictive action of inhibitors in acids is lower than with iron. Comparative investigations in various acids were undertaken to obtain a numerical evaluation of these differences. The acids were of varying concentration with and without inhibitors and the tests were conducted at temperatures of 20°, 40° and 60°C. The solution tests were completed by means of electrochemical measurements. In this way, it was established in particular whether the reactions at the cathode or at the anode were influenced by the addition of inhibitors.

Corrosion Behaviour of Austenitic 18-8 Cr-Ni Steels in Aqueous Solutions Containing Halogens

By C. Carius

A portrayal of the behaviour of 18-8 Cr-Ni steels in water and in aqueous salt solutions must be constructed on the basis of a theory of the passivity of these steels. The passivation courses of three types of stainless and acid-resisting austenitic chrome-nickel steels were described by means of time potential curves in water at room temperature.

Study of Trans-Crystalline Stress Corrosion of Ferritic and Austenitic Steels

With regard to the Stress-Corrosion of steels, most of the reports in the technical literature are concerned with the occurrence of inter-cryalline cracks in austenitic steels. It is shown in the paper as to what influence the tensile strength and mechanical stressing have and, further, that slag inclusions and unhomogeneity of the metal structure in the steel are specially prone to give rise to attack and influence the crack formation. Finally, mention is made of the role of the constructively conditioned stress points and of the significance of toughness of the steel.

An indication is given of alleviating measures, both of the material and also by change of the chemical processing technique and application of inhibitors. The question is discussed, whether it is useful to differentiate between anodic and cathodic stress corrosion.

Control of Hardness of Hard Chromium by Bath Constants

H. Benninghoff. *Centre d' Information du Chrome Dur, Paris,* March 1954, pp. 8-15.

The hardness of chromium deposits is greatly influenced by the plating conditions. Decisive factors here are:

a). Bath temperature and current density applied.
b). Chromic acid concentration.
c). Foreign acid content of the bath in ratio to the chromic acid.
d). Percentage of foreign acid in the bath, with respect to the chromic acid.
e). Percentage of foreign metals in the bath.
f). Trivalent chromium concentration.

The influence on the hardness by these factors is shown by means of curves and tables, in all the working ranges of the bath which are of practical interest in hard chromium plating. The practical conclusions may be summarized as follows:

1. The hardness of chromium deposits increases at constant temperature with rising current density.
2. The hardness increases with constant current density and falling temperature.
3. With constant temperature the hardness increases with increasing current density up to a maximum and then falls away strongly.
4. The most favorable working temperature is 50-55°C. and current densities, 30-60 amp./sq. dm. by which brilliant, hard chromium coatings are deposited with a Vickers hardness which lie between 750 and 1,100 kg./sq. mm.
5. Increase of the CrO_3 content at all temperatures and current densities results in reduction of the hardness of the deposits.
6. The hardness increases with falling bath temperature, falling chromic acid concentration and rising current density.
7. The indirect influence of the sulfuric acid content of the chromium baths on the hardness of the deposits is as follows: With increasing percentage of H_2SO_4 in ratio to the chromic acid present in the bath, the bath must be worked at higher current densities and simultaneously at higher temperatures. The current efficiency falls hereby.
8. With too-low a content of sulfuric acid in a hard chromium bath, only soft, gray deposits are obtained.
9. Metal cations (Al - Cd - Co - Cu - Fe - Na - Ni - Zn) increase the hardness to a small amount. With too high a concentration the deposits tend to become matt, brittle, cracked and soft.
10. With increasing Cr_2O_3 content a constant hardness is obtained even with 5-10 g./l.
11. With a concentration of more than 15 g./l. Cr_2O_3 there is formed a dull, rough, brittle and less hard chromium deposit.

PATENTS

(*Continued from page* 69)

Gas Plating on Molybdenum

U. S. Patent 2,711,973. *June* 28, 1955. *E. Wainer and R. A. Kempe, assignors to Thompson Products, Inc.*

The method of producing a corrosion- and temperature-resistant molybdenum article which comprises passing volatilized silicon tetrachloride in a stream of hydrogen in contact with a molybdenum article at a temperature of 1600° to 188°F. to thereby decompose said silicon tetrachloride and maintaining said article in contact with said stream for a period of at least two hours and until the surface of the molybdenum reacts with the silicon resulting from the decomposition of the said silicon tetrachloride to form oxidation-resistant intermetallic compounds of molybdenum and silicon at the molybdenum surface thereby producing a silicon coated molybdenum article characterized by the presence of intermetallic compounds of silicon and molybdenum having a proportionately smaller silicon content from the exterior silicon layer to the molybdenum body.

Bright Nickel Plating

U. S. Patent 2,712,522. *July* 5, 1955. *O. Kardos, T. J. Menzel and J. L. Sweet, assignors to Hanson-Van Winkle-Munning Co.*

A process for producing bright nickel deposits which comprises electrodepositing nickel from an aqueous acidic solution of at least one nickel salt in which there is dissolved from about 0.2 to about 3 grams per liter of an acetylenic compound selected from the group consisting of 2-butyne-1,4-diol, 4-methoxy-2-butyn-1-ol, 3-hexyne-2,5-diol, 4-diethylamino-2-butyn-1-ol, 4-(N-morpholinyl)-2-butyn-1-ol, 3-pentyn-1-ol, 2,4-hexadiyne-1,6-diol, and 1-diethylamino-2-propyne.

Abrasive Belt

U. S. Patent 2,712,987. *July* 12, 1955. *W. H. Storrs and A. J. Wells, assignors to The Hartford Special Machinery Co.*

The process of producing an abrasive

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element, having abrasive grains at the surface of a predetermined nominal size, which comprises softening a surface of a base material consisting of synthetic linear condensation polyamide only adjacent the surface by a solvent to a depth not in excess of three times the nominal grain size, imbedding abrasive particles in the polyamide only where the surface is softened while retaining the interior of the polyamide unchanged, and removing the solvent.

News from California

By Fred A. Herr

Who is the oldest plater in the United States with the longest record of continuous service in the metal finishing industry to his credit?

This question was posed when a few old friends gathered recently at the home of *John Merigold*, 9946 Live Oak Drive, Temple City, Cal., to help John celebrate his 83rd birthday.

Clarence Thornton was there, who himself spent a quarter century in the business in Chicago before he migrated to Los Angeles some 25 years ago to manage L'Hommedieu's Southern California branch. And *Earl Coffin*, a job shop owner (Palace Plating Works, Los Angeles) for 25 years; *Carroll McLaren*, who recently disposed of his Santa Ana (Cal.) Plating Works, to take up selling equipment, and several other young old-timers were there.

Mr. Merigold contended that his 63 years as a plater should very nearly give him the record, unless someone is heard from to dispute it. John's span covers the period from 1892 to 1955. He started at the age of 19 in Staunton, Mass., and later worked in job shops in Attleboro, Mass., and Providence, R. I., before moving to Newark, N. J., where he owned and operated shops for nearly 20 years. In 1921 he came to the West Coast and operated the Merigold Plating Co., a precious metal finishing plant, for 25 years.

John has been in semi-retirement since 1945 but insists that his "longevity" record was not ended by his retirement because he has a small plating plant set up in his garage in Temple City in which he works often enough to continue to qualify as an active plater. To be sure, this activity is now confined to plating an occasional watchband, but John contends that still makes him a plater and keeps his 63 record going.

If there is anyone around in the United States or Canada who can top that, John would like to hear from him.

Herman J. Struckhoff and *Kenneth S. Repp*, both of whom served for many years with Lasalco, Inc., in St. Louis, Mo., have established themserves in business in Los Angeles under the firm name of Laco Engineering & Sales, Inc., as distributors of metal finishing processes and equipment. Struckhoff is president, and Repp secretary. Their offices and warehouse are at 100 North Santa Fe Ave., Los Angeles.

Struckhoff is the incumbent president of the Metal Finishing Suppliers' Association, of which *Thomas A. Trumbour*, general manager of *Finishing Publications, Inc.*, has been a guiding spirit for many years. Both Struckhoff and Repp are members of St. Louis Branch of the A.E.S.

Glenn Beckwith, vice-president and general manager of Metallon Products, Inc., Los Angeles, reports his firm has acquired an 8,000 square foot industrial building at 1851 Randolph St., adjacent to Metallon's main plant, for use in the manufacture of casters, rollers and Bakelite wheels. Major finishing of those items will be handled in Metallon's main plant, but some zinc plating equipment will be included among the production units in the caster plant, Beckwith reported.

Jack Raskin has been named a vice-president of the L. H. Butcher Co., Los Angeles, a subsidiary of Udylite Corp. He was formerly a chemical engineer for Udylite. Raskin joined the Butcher Co. in 1945 as manager of the metal finishing department, with supervision over the firm's plating activity in Los Angeles, San Francisco, Seattle, Portland and Salt Lake City. He will continue to function in that capacity in addition to his new duties as vice-president.

The Esbec Barrel Finishing Corp., Byram, Conn., has announced the appointment of *E. W. Denny* of the Denn-Burr Process Co., Arlington, Cal., as Southern California representative. Denny was formerly a development engineer for General Electric Co. Inventories of Esbec barrel finishing compounds are now available in Denny's Arlington warehouse for expediting

service to the Southern California trade.

International Rectifier Corp., El Segundo, Cal., has established a product information department to expedite the dissemination of information about the firm's products. *Fred Genge* heads the new department.

Utility Appliance Corp. of Los Angeles has installed an entirely new finishing department in conjunction with a recent expansion program. Since existing facilities for cleaning, painting and baking Utility's products (gas furnaces, heaters, blowers, air coolers, air conditioning units) could not effectively be incorporated in the modernization plans, a complete mechanized finishing system was installed.

The new finishing equipment is fully conveyorized and replaced one which was partially conveyorized and consisted of a trichlorethylene degreaser, eight-foot spray booths, paint dip tanks and a U-type conveyorized paint bake oven.

The new equipment is installed in a 105,000 sq. ft. building approximately 200′ x 500′ in dimensions. The building contains shear, fabrication, subassembly and finishing departments, with the latter occupying the site of the former finishing machinery. The flow of material begins in the old, adjacent building where the conveyors are loaded to carry parts to the new finishing line.

New equipment consists of a five-stage, double-tunnel phosphating machine 108 feet long. Each of the two tunnel units consists of a 12 foot alkaline wash, 10 foot drain section, 12 foot rinse, another 10 foot drain, a 12 foot phosphate coating section, and cold rinse, chromic rinse and a final 10 foot drain section.

Other major equipment units in the finishing department consist of automatic lubricators, a 15 foot water wash spray booth, double tandem flow coater, vapor tunnel, and a double tunnel bake oven with an overall length of 178 feet.

Pemaco Plating Co., 2125 Lemon Ave., Alhambra, Cal., has completed installation on a new tumbling facility for use on die-cast furniture hardware parts, such as knobs, bolts and drawer handles.

Jerry Perring owner, reported that the new tumbling unit supplemented a complete new installation for plating and polishing brass which was installed earlier in 1955. That equipment consists of 13 plating, rinse, acid and cleaner tanks. Installed at the same time was a conveyor system for spraying baked enamel furniture hardware parts and a new infra red oven. The firm occupies a 10,000 sq. ft. shop at the northeastern edge of Los Angeles, which Jerry has operated for the past ten years.

A stable zinc market with no price increase for at least nine months was predicted by *M. D. Schwartz*, general manager, Pacific Smelting Co., Torrance, Cal., in an address before the recent national convention of the National Waste Material dealers at Los Angeles.

Declaring that the zinc industry has enjoyed an unprecedented economic stability for the last two years, Schwartz stated that the orderly market, upsetting the usual pattern of the last 25 years of wide and frequent price fluctuations, resulted in a banner year for zinc sales.

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1500	40/65	G. E.
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6000 Ampere, 9 Volt Richardson-Allen rectifier, 3 phase, 60 cycle, 440 volts, new 1953.
4000 Ampere, 12 Volt Bart-Messing, type 40012-RW, water cooled rectifier with automatic voltage control, 3 phase, 60 cycle, 440 volt, new 1953.
3000 ampere, 6 Volt Bart-Messing, type 3006WP water cooled rectifier, remote panel, new 1953.
3000 Ampere, 24 Volt General Electric, 720 RPM, any A.C. Voltage.
1600 Ampere, 24 Volt General Electric, 720 RPM, any A.C. Voltage.
1500 Ampere, 6 Volt Richardson-Allen, 3 phase, 440 volt, new 1953 (3).
1000 Ampere, 24 Volt Century, ballbearing, any A.C. Voltage.
750 Ampere, 24 Volt Westinghouse, any A.C. Voltage.
26—Additional Units, various Voltages and Amperes.

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1—Production Machine 101 Double roll feed.
1—Duplex 484 Production, Like New.
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1—4 Spindle Semi-Automatic.
1—8 Spindle Semi-Automatic.

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1—1000/500 amp. 6/12 v. Bogue outside ex.
1—5000/2500 amp. 8/16 v. Bogue.

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2—Gardner 5 H.P.
1—Double Pesco 5 H.P.

SILVER POLISHING SET UP
1—Double 15 H.P. Pesco Polishing Lathe.
1—8-10 Acme with A-2 head and expanding chucks.
1—Automatic Single Spindle Machine with Stroke.

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1—10 x 22 Lead Lined
1—SDNR8 Alsop S.S.
1—SDWR8 Alsop Steel
1—SDWR12 Alsop

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1—Kreider 12".
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1—Ronci #R-200.

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5—60"x36"x36" stainless steel, complete with overflows, ducts, and pipe connections.
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1—Divine Electric Glue Table w/6 pots.
1—Blakeslee Full Automatic Barrel Type Degreaser.

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Metal parts conveyor washing machine, Model #CT 30x15, Industrial Systems Co., 2 stages wash and rinse with hold down opening 30" wide x 15" high. Conveyor speed 12½ x 31¼ F.P.M., overall length 25 ft., height 6 ft. 2½". Hot water caustic solution type. Purchased new Dec. 1952, never used. Price F.O.B. Oneonta, N. Y. plant $4,000.

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Major items are as follows:
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1—chrome tank 23 x 30 x 35.
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2—buffing lathes, buffing and polishing wheels and blower system.

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Divine Bros. 4 stage auto polisher and buffer with 15 ft. motorized conveyor, and 4 pneumatic adjustment 20 H.P. motorized wheel heads. Can be used for polishing continuous rolls, or strip, trim, molding, hardware, iron and appliance parts. Cost new $18,000. Will give away at fraction of original investment. Photos available. Stafford Co., 145 - 58th St., Brooklyn, N. Y.

PLATING MACHINE WANTED

F. B. Stevens Model C small parts plating machine.

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SITUATION OPEN — Distributors, jobbers and manufacturers agents wanted to distribute and sell the full line of Schaffner's polishing and buffing composition in bar, spray or paste form, and a complete line of polishing room supplies.

SCHAFFNER MANUFACTURING COMPANY, INC.

Emsworth, Pittsburgh 2, Pa.

PLATER

SITUATION OPEN—Plater, analytical chemist, production engineer wanted for job shop in consultant position, trouble shooting, plating and metal finishing problems, setting up cycles for barrel plating. Experienced in commercial barrel plating of small parts. Barrel gold, chrome, nickel, copper and silver —also barrel finishing procedure and its compounds, deburring, ball rolling, etc. Cost and time study, recommended and design time saving devices, complete up-to-date laboratory for research and development. Give full business, personal background and salary expected in first letter. Address: September 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

METAL CLEANER SALESMAN

SITUATION OPEN: We need experienced, successful technical sales representative with proven sales record for expanding sales program. Must know plating, phosphating, porcelain enameling, other finishing. Liberal draw, commissions, expenses, car, other benefits. Write age, experience, income requirements, territory preferences.

COWLES CHEMICAL COMPANY
METAL CLEANER DEPARTMENT
7014 EUCLID AVENUE
CLEVELAND 3, OHIO

WANTED

Manufacturers representative or sales agency thoroughly experienced in paint and allied products to handle synthetic aluminum coating with high salt spray resistance. Sell to primary and secondary metal fabricators. Companion product has application in small forgings. Liberal commissions. Write complete information, experience, lines handled, territory covered. Address: December 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

BUFF MANUFACTURER'S AGENT

SITUATION OPEN—Active agents wanted who are now handling allied lines. Territories open include Ohio, Western Pennsylvania, Indiana and Michigan. We will consider exclusive territories and will support agents with extensive sales program. Complete line of buffs and polishing wheels. We are long established in the East; have an excellent reputation for quality and service. We are now prepared to extend this service into the Mid-West. Replies confidential.

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SITUATION OPEN—Chemist, graduate, for customer service and process control work, in laboratory of Connecticut metal finishing supplier. Must have some experience with plating processes and solution analysis. Salary $5000 to $6000 per year, depending on qualifications. Excellent opportunity for advancement into sales or administrative work. Please submit resume. Address: December 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

MANUFACTURER'S AGENTS

SITUATIONS OPEN — Manufacturer's agents and distributors wanted to handle our line of polishing and buffing compositions. Address: January 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

SALESMAN

SITUATION OPEN — Electroplating equipment manufacturer offers excellent opportunity for man with experience in selling this type of equipment and supplies in the Midwest. State experience and qualifications. Address: January 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

CHEMICAL TECHNICIAN

SITUATION OPEN—Man with good background in organic and physical chemistry wanted to work in the development of chemical treatments for the metal finishing industry. Excellent opportunity for a qualified man to join a well-established, growing business. Location, Midwest; salary, dependent on qualifications, plus profit sharing, pension, group insurance plans. Write in detail. Address: January 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

SITUATIONS WANTED

PLATER

SITUATION WANTED—Plater with fifteen years experience, ten years as foreman, of plating, polishing, buffing and barrel finishing departments. Would prefer a job with small manufacturer. Can furnish the best of references. Address: January 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

FINISHING SUPT.

SITUATION WANTED—Desire position as Finishing Supt. in metal fabricating line. Have 35 years experience as finishing supervisor in all phases of plating, polishing and lacquering and pigmented materials. Extensive experience with copper, nickel, chromium, brass, zinc and silver plating, both in barrel and still tank operations. Experience in following lines: luggage hardware, building hardware, holloware, automotive accessories, tubular furniture. Analyze, control all types solutions. Address: Jan. 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

FOREMAN POLISHER

SITUATION WANTED—I have 27 years experience on all metals. Capable of handling men and teaching beginners. Production and estimating on all types of work — floor lamps, hardware, silverware, plumbing supplies, jobbing shops and chandeliers and electrical fixtures. Address: January 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

BUFFING AND FINISHING SUPERVISION

SITUATION WANTED—I have 18 years experience on metal polishing and finishing; have worked on copper, brass, sand polishing, and finish inspection on silverware. I have taught others to buff and polish and understand production control. Address: December 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLATER

SITUATION WANTED—Experienced in analysis and most types of plating and finishing; also anodizing in white, black and colors. Address: December 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

ELECTROPLATING SUPT. OR MANAGER

SITUATION WANTED—Have 25 years of experience in all types of electroplating and anodizing. Can make up and maintain solutions; also full knowledge of buffing, metal spraying, soft soldering and white metal casting. Have been in supervisory capacity for past 15 years. Address: December 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

SUPPLIERS OF EQUIPMENT AND MATERIALS AND ADVERTISERS INDEX

EQUIPMENT and SUPPLIES ADVERTISED *in this Issue*

A handy reference list of specific items; the number refers to the page of a manufacturer's advertisement. When writing to these firms, we would appreciate your mentioning our publication.

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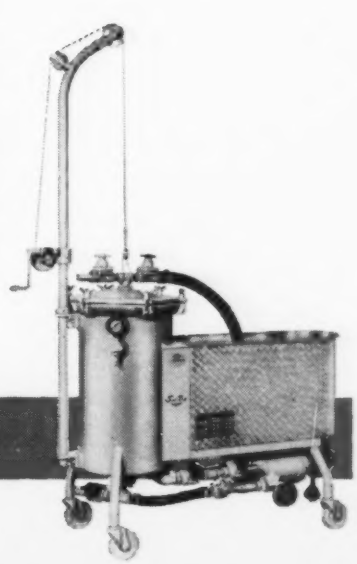

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